# ELECTRICAL TIMES

THURSDAY
6 SEPT.
1951
NINEPENCE



## For multi-storey buildings

If you have a problem [illegible] the distribution of electricity supplies in [illegible] storey buildings or small blocks of flats, Henley's can provide the solution. The HENLEY Rising Main System for large buildings; HENLEY Metalclad Distribution Boxes [illegible] two or three storey dwellings.

*ENGINEERING MARINE & WELDING EXHIBITION, OLYMPIA.—Visit Stand No. 2, Row "O" National Hall.*

**Tybald's Close, London, W.C.1.**
A Henley Rising Main Installation by The London Electricity Board.

## or 2 or 3-storey flats

Henley metalclad distribution box for small blocks of flats as installed by the Midlands Electricity Board for the **Birmingham Corporation Housing Dept.**

**Please write for Literature Ref. 46 which gives complete details.**

**HENLEY**

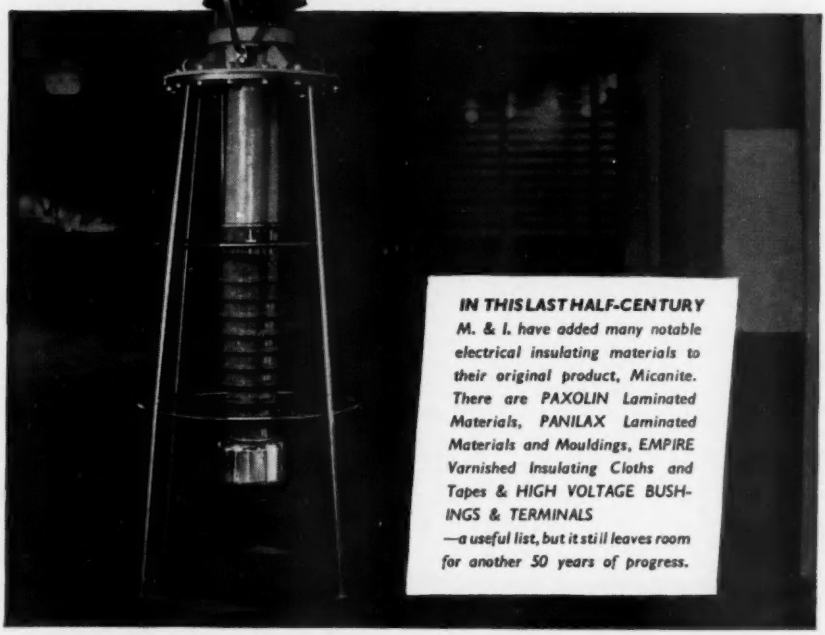
**ELECTRICAL DISTRIBUTION EQUIPMENT**

**W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.**
**51-53 HATTON GARDEN, LONDON, E.C.1**

Between

# FESTIVAL AND JUBILEE

This Festival showpiece in the Kelvin Hall, Glasgow, a 275 kV bushing is also a Jubilee showpiece for The Micanite & Insulators, who are making such bushings for the National Super Grid.
After 50 years of electrical enterprise, M. & I. are proud to cap their Jubilee with these 275,000 volt bushings; they are preparing now to manufacture for even higher voltages.

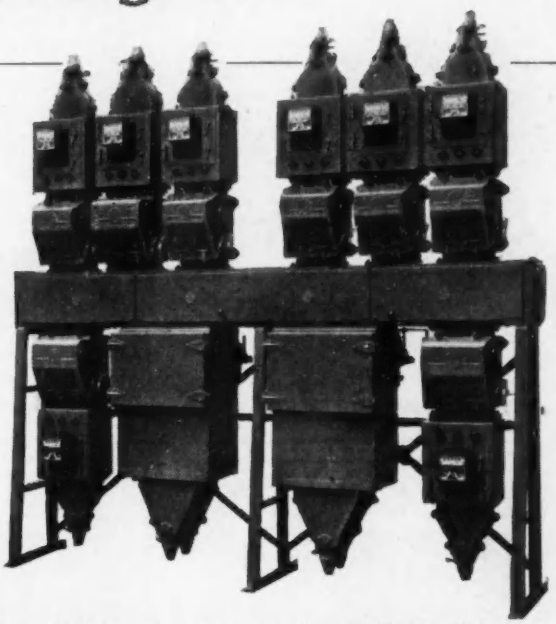


***IN THIS LAST HALF-CENTURY***
*M. & I. have added many notable electrical insulating materials to their original product, Micanite. There are PAXOLIN Laminated Materials, PANILAX Laminated Materials and Mouldings, EMPIRE Varnished Insulating Cloths and Tapes & HIGH VOLTAGE BUSHINGS & TERMINALS*
*—a useful list, but it still leaves room for another 50 years of progress.*

m and i

**THE MICANITE & INSULATORS COMPANY LTD**
*Empire Works, Blackhorse Lane, Walthamstow, London, E.17.*

# 'ENGLISH ELECTRIC'
## fusegear



### Floor space is PRODUCTION space

Floor space available is one of the first yardsticks of productive capacity. Excessive encroachment by factory fixtures is uneconomic; such fixtures should be inconspicuous, trouble-free, offering minimum obstruction of gangways, occupying space otherwise unproductive.

'English Electric' Combination Fuse-Switchboards are designed to permit direct-to-wall mounting with all parts accessible from the front; back access is unnecessary. Maximum projection from the wall of the board illustrated is only 1 foot 10¾ inches, the equipment using, in effect, walls *instead of* production floor-areas.

Construction of these boards is arranged to give the greatest adaptability. Units are clamped to the busbar and busbar chamber, and may be re-arranged or added to in order to keep pace with changing factory needs. The board illustrated controls four 300-amp and four 150-amp feeder circuits, with two 500-amp incoming switches.

**The ENGLISH ELECTRIC Company Limited**

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Fusegear Works: East Lancashire Road, Liverpool 10

*Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL*

A

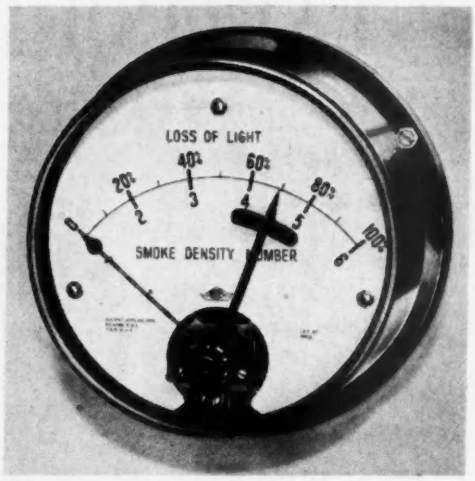
# PULLIN CONTACT AMMETERS AND VOLTMETERS

**Contact meters, for controlling auxiliary circuits, have now been added to the wide and varied range of Pullin instruments.**

**An entirely new principle has been developed whereby the contacts are "floating" on an adjustable pointer, which can be set to any pre-determined scale value. These contacts are completely isolated from the moving coil system, thus simplifying the connections.**

**An ingenious device has been employed which overcomes the inertia of the contacts operated by the instrument pointer, and also nullifies contact chatter on A.C. so reducing the tendency to stick.**

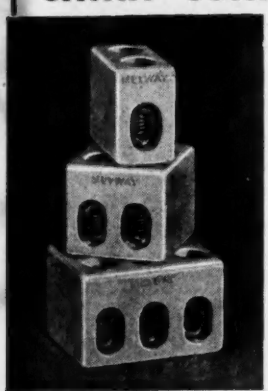
**The contacts can be actuated to within 1% of any pre-determined scale value with all voltmeters and with ammeters down to 1 milliamp.**




*(Patent applied for) Illustrating a typical scale. Any scale can be supplied to suit individual requirements.*

**MEASURING INSTRUMENTS (PULLIN) LTD., Electrin Works, Winchester St., W.3. Tel: ACOrn 4651-3**

## CHINA CONNECTORS



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5-15 AMP

PROMPT DELIVERY *at the moment.*

Full details of *all* Metway Wiring Accessories are given in our **92-page LIST No. OH/31/JJ3/TE**

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## THE STEEL COVERED HEATER WITH 1001 USES

IN its variety of forms, the Cressall steel-jacketed unit heater is the solution to most heating problems. Let a Cressall Technical Expert discuss heating with you before you decide. He will be happy to help.

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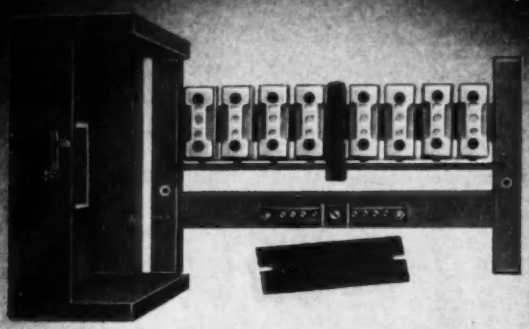
*You cannot buy better gear*



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MADE FOR 5/15, 15, 20 AND 30 AMPERES, 250 VOLTS: 1-12 WAY: DOUBLE POLE, SINGLE POLE AND NEUTRAL.

MIXED AMPERE FUSEWAYS TO SPECIAL ORDER.

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# "Belling"

For the convenience of our customers the following are the revised List Prices (which became effective from August 20, 1951) of some of the most popular Belling products. A complete list of revised prices is available on application

## ELECTRIC COOKERS

| | | | | | |
|---|---|---|---|---|---|
| No. 29 Table Cooker | £7 12 0 | No. 47 Cooker | £27 17 6 |
| No. 29SW Table Cooker | 6 18 0 | No. 47A Cooker | 29 10 0 |
| No. 45A Baby Cooker | 13 15 0 | No. 47AB Cooker | 31 15 0 |
| Cabinet for 45A | 4 8 0 | 8 in. Radiant Plate | 1 5 0 |
| Stand for 45A | 2 4 0 | Simmerstat | 15 6 |
| No. 46 Cooker | 25 0 0 | Utensil Drawer | 1 2 0 |
| No. 46A Cooker | 26 12 6 | No. 64AB Cooker | 49 10 0 |
| No. 46AB Cooker | 28 17 6 | Wheels | 2 15 0 |

## ELECTRIC FIRES AND SPACE HEATERS

| | | *List Price* | *Total Price inc. Tax* |
|---|---|---|---|
| No. 961A | Air Warmer | £2 4 0 | £3 16 5 |
| No. 962A | Air Warmer | 2 12 6 | 4 11 2 |
| No. 121 | Beacon Fire | 1 18 0 | 3 6 0 |
| No. 122 | Beacon Fire | 2 15 0 | 4 15 6 |
| No. 91A | Champion Heater | 3 11 0 | 6 3 3 |
| No. 92A | Champion Heater | 4 2 6 | 7 3 2 |
| No. 83A | Champion Heater | 4 8 0 | 7 12 9 |
| No. 751 | Convector | 6 14 0 | 11 12 6 |
| No. 752 | Convector | 10 14 0 | 18 11 4 |
| No. 231 | County Fire | 4 19 0 | 8 11 10 |
| No. 232 | County Fire | 6 0 0 | 10 8 3 |
| No. 601 | Dinkie Fire | 1 7 6 | 2 7 9 |
| No. 602 | Dinkie Fire | 2 4 0 | 3 16 5 |
| No. 401E | Empire Fire | 1 15 0 | 3 0 9 |
| No. 402E | Empire Fire | 2 15 0 | 4 15 6 |
| No. 403E | Empire Fire | 3 14 0 | 6 8 5 |
| No. 952 | Handy Heater | 1 18 0 | 3 6 0 |
| No. 159 | Hearth Fire, coal | 7 9 0 | 12 18 7 |
| No. 159A | Hearth Fire, logs | 9 0 0 | 15 12 4 |
| No. 155 | Homeguard Fire | 8 5 0 | 14 6 4 |
| No. 141 | Hotspur Fire | 2 10 0 | 4 6 9 |
| No. 142 | Hotspur Fire | 3 8 0 | 5 18 0 |
| No. 639 | Medieval Fire, coal | 12 13 0 | 21 19 0 |
| No. 639 | Medieval Fire, logs | 13 15 0 | 23 17 2 |
| No. C/1 | Panel Fire | 2 0 0 | 3 9 5 |
| No. C/2 | Panel Fire | 3 0 0 | 5 4 2 |
| No. 131/2 | Panel only | 16 6 | 1 8 8 |
| No. F/2 | Panel Fire | 3 8 0 | 5 18 0 |
| No. G/2 | Panel Fire | 4 15 0 | 8 4 10 |
| No. 133 | Panel only | 16 6 | 1 8 8 |
| No. 212 | Princess Fire | 8 16 0 | 15 5 5 |
| No. 213 | Princess Fire | 10 3 0 | 17 12 3 |
| No. 151 | Solray Fire | 3 17 0 | 6 13 8 |
| No. 85 | Warm Air Circulator | 4 2 6 | 7 3 2 |
| No. 86 | Warm Air Circulator | 6 14 0 | 11 12 6 |
| No. 87 | Warm Air Circulator | 4 8 0 | 7 12 9 |
| No. 263 | Waverley Fire | 15 8 0 | 26 14 5 |
| No. 264 | Waverley Fire | 16 15 0 | 29 1 3 |

## DRYING CABINETS

| | | *List Price* | *Total Price inc. Tax* |
|---|---|---|---|
| No. 107 | Drying Cabinet | £10 10 0 | £15 19 3 |
| No. 108 | Drying Cabinet | 21 10 0 | 32 13 8 |

## WARMING CABINETS

| | | *List Price* | *Total Price inc. Tax* |
|---|---|---|---|
| No. 103 | Warming Cabinet | £5 10 0 | £8 7 3 |
| No. 106 | Warming Cabinet | 14 10 0 | — |
| No. 106S | Warming Cabinet | 16 10 0 | — |
| No. 106GB | Warming Cabinet | 18 15 0 | — |

## TOWEL AIRERS

| | | *List Price* | *Total Price inc. Tax* |
|---|---|---|---|
| No. 104 | Towel Airer, fixed | £4 8 0 | £7 12 9 |
| No. 104A | Towel Airer, portable | 4 18 0 | 8 10 1 |
| No. 105 | Towel Airer, fixed | 5 10 0 | 9 10 11 |
| No. 105A | Towel Airer, portable | 6 0 0 | 10 8 3 |

## BOILING RINGS AND PLATES

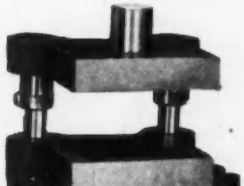
| | | | |
|---|---|---|---|
| No. 15 Boiling Ring | £3 17 0 | No. 18 Boiling Plate | £6 0 0 |
| No. 16 Boiling Ring | 4 2 6 | No. 18SW Boiling Plate | 5 8 0 |
| No. 17 Boiling Ring | 4 10 0 | No. 19 Boiling Plate | 9 4 0 |
| No. 22 Boiling Ring | 1 17 6 | No. 19SW Boiling Plate | 8 0 0 |

***BELLING & CO. LTD., BRIDGE WORKS, ENFIELD, MIDDX. Howard 1212***

# *The Nail and the Battle*

For want of a the was lost. For want of a the was lost. For want of a the message was lost. For want of a message the battle was lost.

Ah ! my friends, what a moral for us all. Now at this very moment, in some toolshop or other, a skilled tool-maker is spending his time making a Press Tool Set when he ought to be making the tool. The tool will be late, delivery will be late, the customer will be lost, the firm will go broke, the Managing Director will blow his brains out—but just a moment; *if he had brains surely he would get his Press Tool Sets from*



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Desoutter Bros. Ltd. The Hyde, Hendon, N.W.9. Phone: Colindale 6346 (five lines). Grams: Despnuco, Hyde, London.
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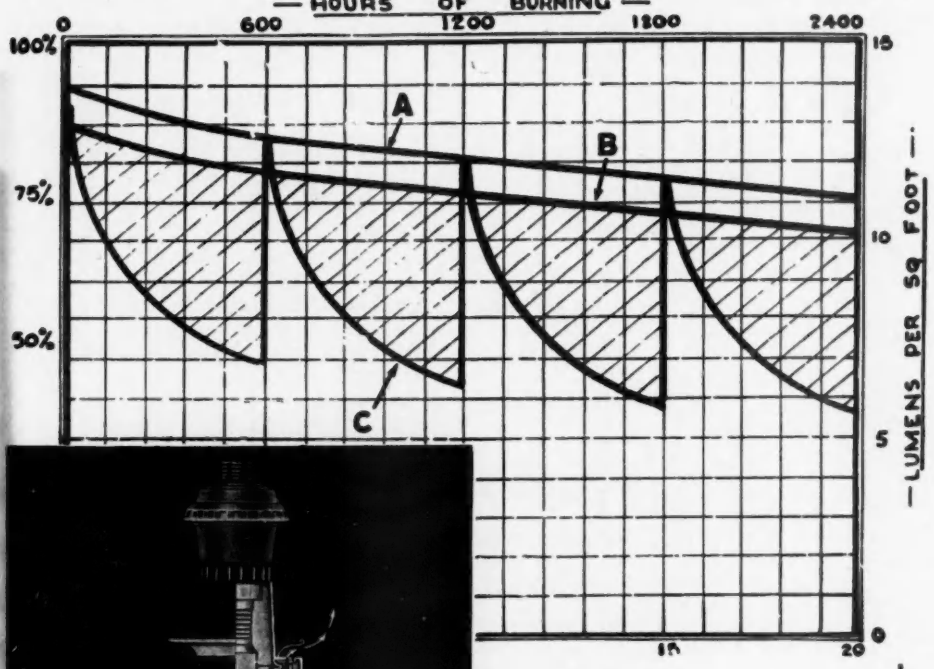
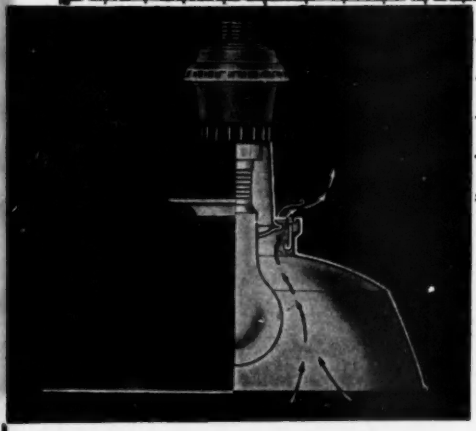
# "MAXLUME STAYCLEAN" FITTINGS

SOLVE MOST

# FACTORY LIGHTING PROBLEMS



**MAXLUME LIGHTING ENGINEERS** will gladly explain the significance of the above curves to you. It may save you £.£.£s.

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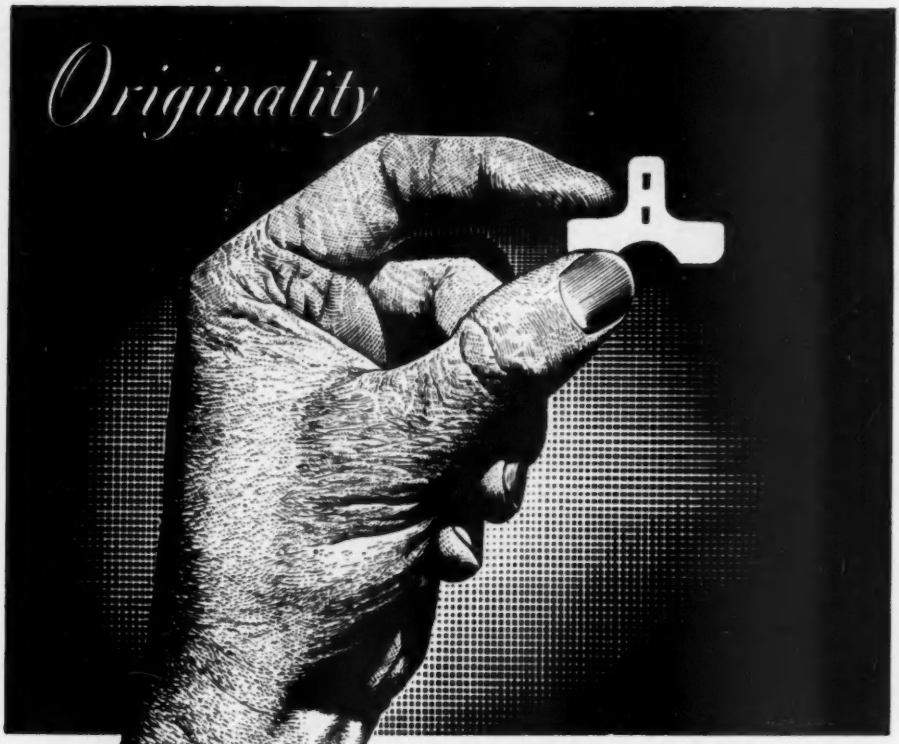


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This little component is the shutter of an "Anti-Flash" socket. It is another MK innovation, first introduced 25 years ago. The purpose is fourfold: to cut off the arc; to ensure that the plug is driven home with a "snap" action; to protect inquisitive children; to exclude dust. This is one of the many original ideas from MK which have so greatly influenced the design of electrical accessories.

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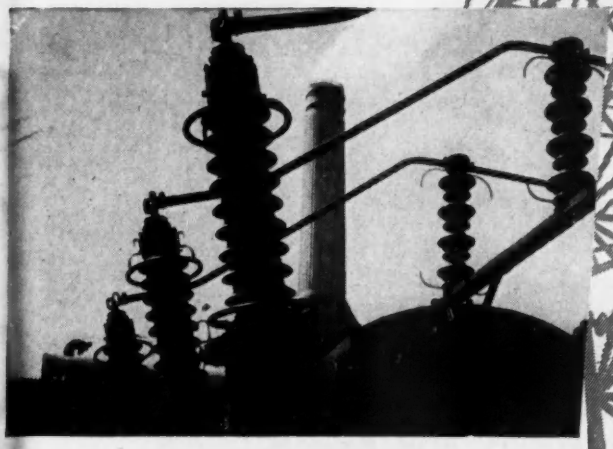
# P & G BATTERIES in the public service



P & G Batteries play an important part in maintaining the efficiency of Britain's giant grid system. In countless substations where the flow of energy is broken down to comply with local needs, there you will find P & G Batteries operating vital switchgear or providing emergency lighting should the mains supply fail. The P & G service extends into many spheres, a natural result of 60 years' experience of battery manufacture and development. In round terms here it is. **1.** *Technical Advice and Specifications.* **2.** *Complete equipment and installation.* **3.** *Regular inspection and report.* A discussion of your scheme may help. We are always ready to agree that two heads are better than one.

**2** *heads are better than* **1**

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**A Foster oil test set in use in their own laboratory. The set is designed to facilitate the rapid testing of insulating oils for dielectric strength in accordance with the recommendation of BSS.148.**

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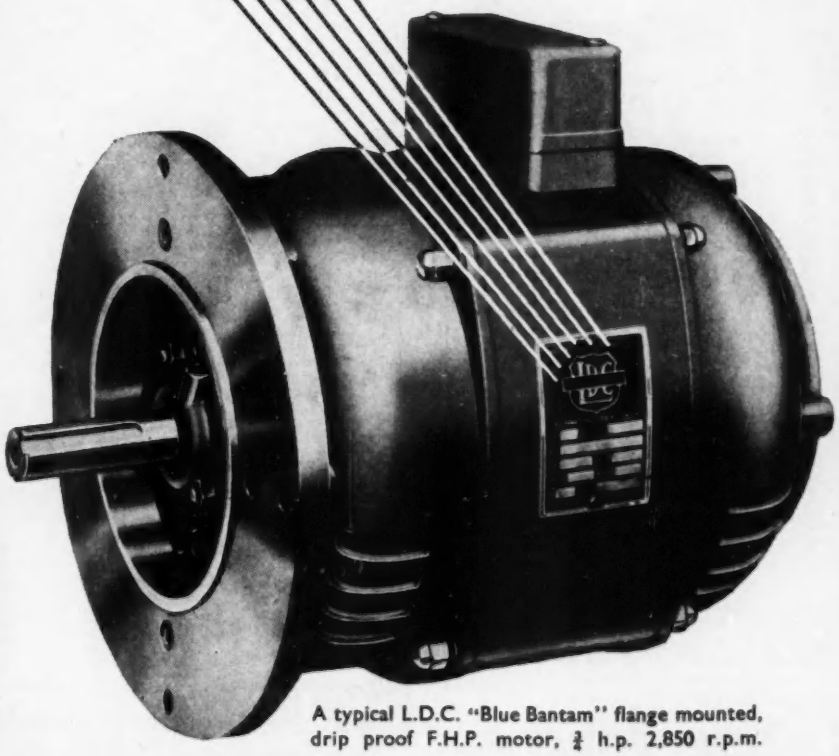
LANCASHIRE CRYPTO

*The Symbol of Power in Industry for over 50 Years*



A typical L.D.C. "Blue Bantam" flange mounted, drip proof F.H.P. motor, ¾ h.p. 2,850 r.p.m.

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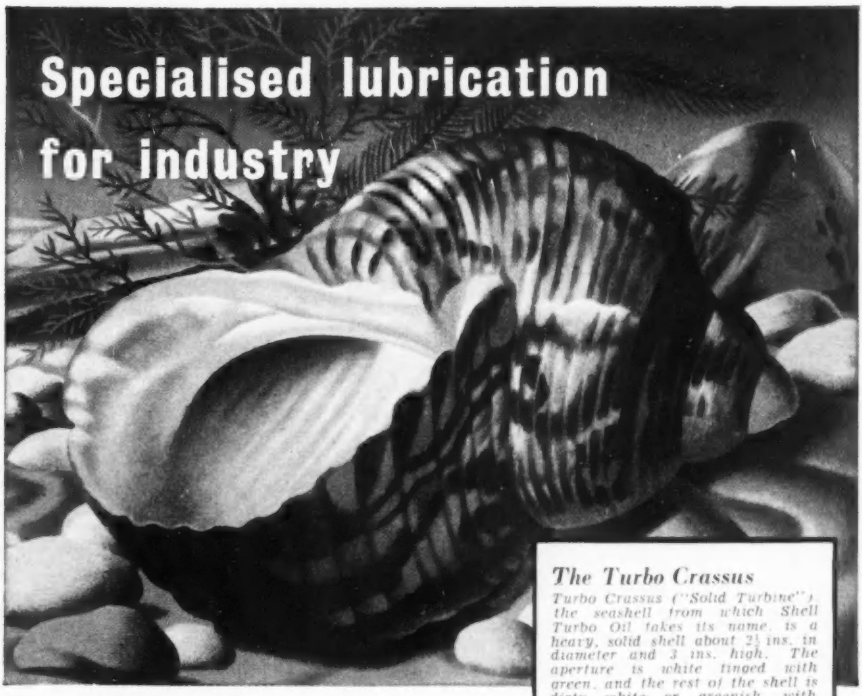


*The Turbo Crassus*

*Turbo Crassus ("Solid Turbine"), the seashell from which Shell Turbo Oil takes its name, is a heavy, solid shell about 2½ ins. in diameter and 3 ins. high. The aperture is white tinged with green, and the rest of the shell is dirty white or greenish, with angular black or brown patches on the ribs. Found off the coasts of North Australia and New Caledonia.*

# SHELL TURBO OIL

SHELL TURBO OILS are highly refined oils containing anti-oxidant and anti-rust additives. They separate readily from water during prolonged service and have outstanding oxidation stability. Available in a range of viscosities, they are recommended for steam, gas and water turbines, bearings of high speed enclosed crankcase steam engines, and certain other circulating systems where oils of turbine quality are required. Shell Turbo Oils are approved by all the leading turbine builders.

The wide Seashell range of specialised industrial lubricants is marketed in nearly every country of the world. There is a Seashell grade for *every* industrial use—and each is available everywhere in the same high quality.

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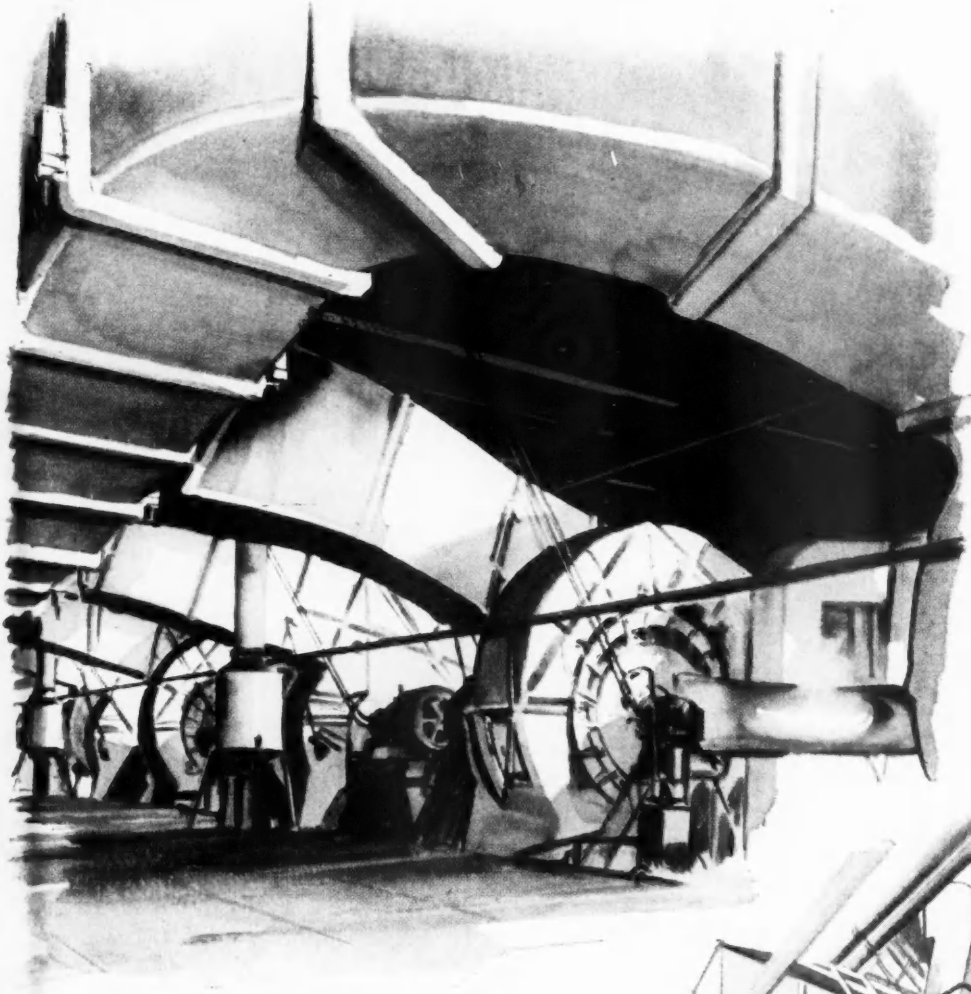
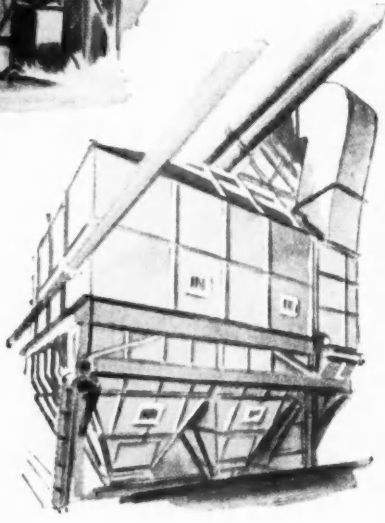
**CALL IN A SHELL LUBRICATION ENGINEER**

Shell Lubrication Engineers will be pleased to provide further information and to make specific recommendations for particular purposes. You can be sure of Shell lubrication—it is *specialised* lubrication.





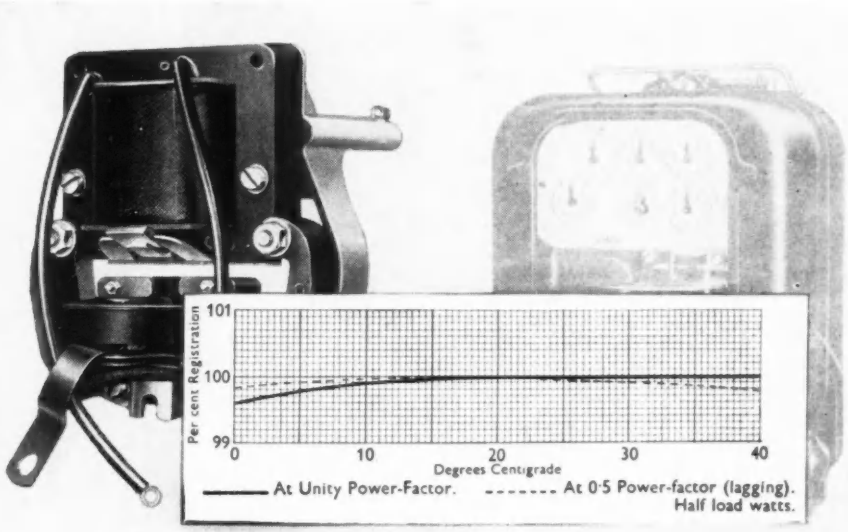
Howden induced draught fans with scroll collectors, at a south coast generating station
Below: Howden Centicell dust collectors at a London Power Station.

# HOWDEN

LONDON & GLASGOW.

# Meticulous Metering

## by the METROVICK TYPE NF Watt-hour Meter




## 7—TEMPERATURE COMPENSATION

**A compensator for non-inductive loads having a negative permeability-temperature characteristic controls the flux so that braking remains practically constant over a wide range of temperature. For inductive loads a temperature compensator of similar material is fitted around a limb of the quadrature loop. The rear view of the meter frame and electro-magnet is shown above, also a curve showing the accuracy of the meter under varying temperatures.**

*Other advertisements in this series :—*
*2—CASES and COVERS : 3—PERFORMANCE : 4—REGISTERING MECHANISM : 5—DAMPING SYSTEM : 6—RESILIENT BEARING : 8—ACCESSIBILITY and TERMINALS : 9—CALIBRATION ADJUSTMENTS.*

***WRITE FOR A COPY OF PUBLICATION S.S.P. 7356/2***

**METROPOLITAN-VICKERS ELECTRICAL CO. LTD.**
*MANCHESTER 17, ENGLAND*
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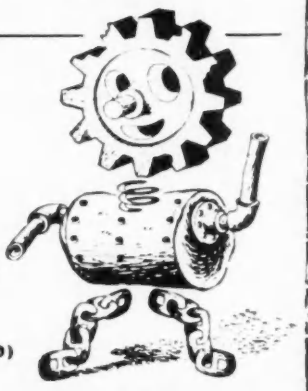
# WANTED!

## NEW STEEL

**alias JACK SCRAP**

(MAY BE IN HIDING OR DISGUISED)



Bring your detective powers to bear on the search for scrap and you'll probably unearth tons of it disguised as old plant you never use or hidden in out of the way corners of your warehouses, stockrooms and yards.

The new steel every industry needs can be made from the old steel it has done with. Find all you can. Round it up. Turn it in.

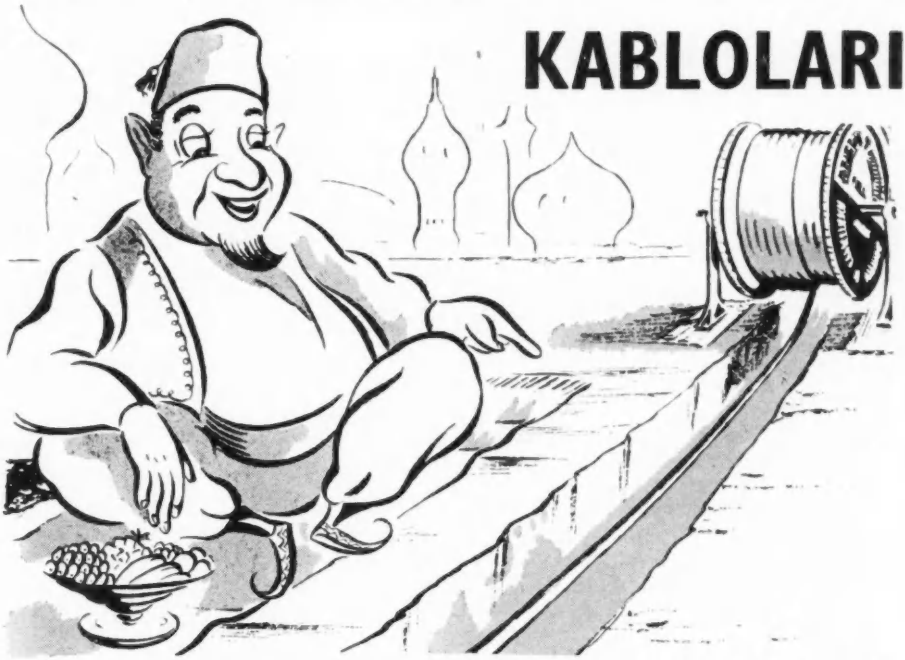
**WANTED**
from the
**ELECTRICAL INDUSTRY**
Old engines and transformers and *every kind* of general and process scrap and obsolete plant

**Your scrap merchant will help with dismantling and collection.**

***SPEED THE SCRAP*** *SPEED THE STEEL*

**Issued for the STEEL SCRAP DRIVE by the British Iron and Steel Federation, Steel House, Tothill Street, London, S.W.1**

# J.& P. ALUMINYOM KAPLI KABLOLARI



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SHEATHED CABLES

Engineers the world over readily appreciate the advantages of aluminium sheathing even when described in Basic English.

British Patent Nos. 627815 & 627793.

JOHNSON & PHILLIPS LTD.

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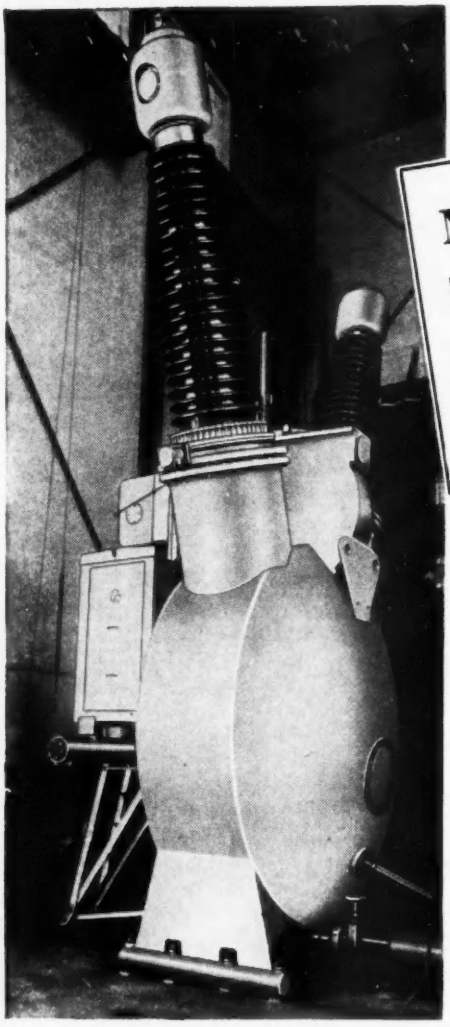
*The mark that means that "little more" in quality*

# "Shuntarc" 275/300-kV Oil Circuit-Breaker



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**7500-MVA**
BRITISH RATING

**9400-MVA**
AMERICAN RATING

Tested for breaking capacity on one pole to B.S. 116-1937, the lower current tests being taken with 260-kV recovery voltage across one pole, the higher current tests being unit tests. The circuit breaker is of multi-break construction, each break being shunted by a linear resistor.

The circuit-breaker is suitable for instantaneous auto-reclosing duty.

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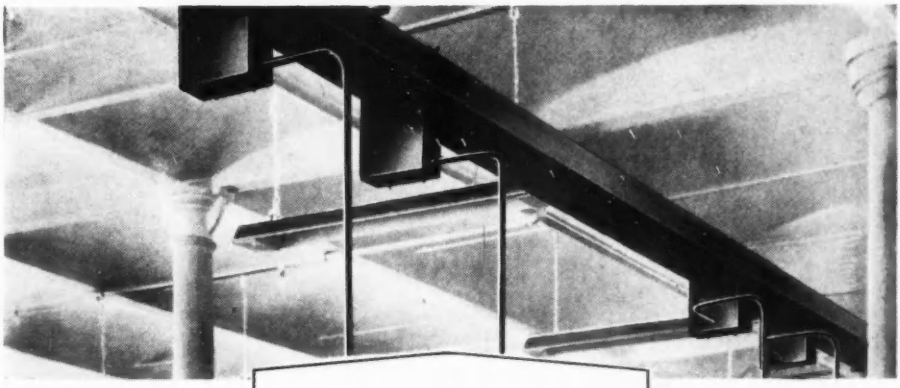

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This modern method of power distribution in industry enables power installation layouts to be achieved with minimum labour costs. Installations can be modified or extended to keep pace with developments in the capacity and equipment of the factory without interruption of normal output.

- Reduced maintenance costs.
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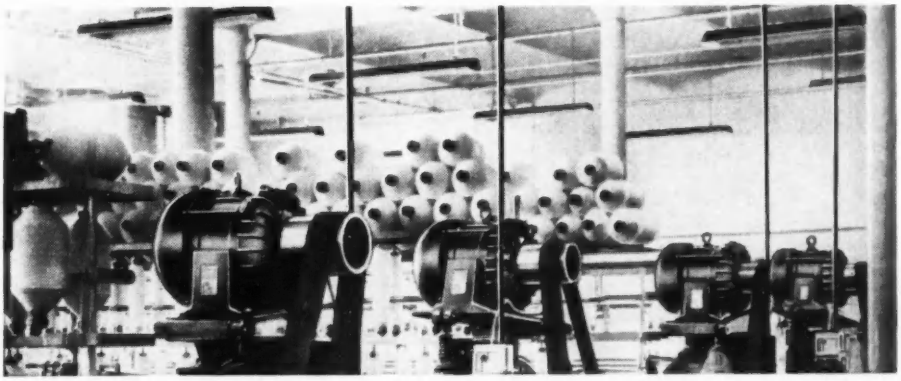
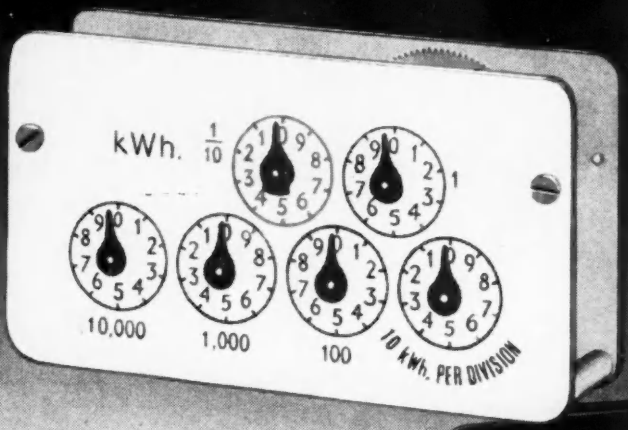
- Flexibility of distribution.
- Tap-off units in horizontal vertical or double circuit types with maximum wiring space.
- Efficient earth continuity.
- Busbar supports of highest grade porcelain.
- Expansion couplings compensate for temperature variation.
- Minimum voltage drop.

*Write for particulars of G.E.C. Industrial Metalclad Distribution Systems*



THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

# The FERRANTI F.M. Meter




## THE POINTER TRAIN

**This registering mechanism is made of light alloys and has a very low friction level. The bearings have anodised surfaces and no lubricant is required.**

**This is but one of the many unique features of the Ferranti F.M. Meter, epitomising the cumulative experience of over 60 years of meter design and manufacture.**

FM95

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# Cut-out for Rural Development

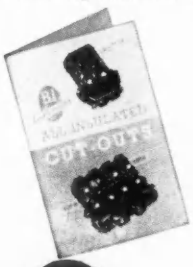
Rural development schemes, largely serviced from overhead lines or H.S.O.S. distributor cables, need specially designed cut-outs.

The B.I.C.C. range of All-Insulated Cut-Outs includes a double pole model, without sealing chamber, specifically produced for use with overhead services, and designed for convenience of installation.

They are non-ignitable, corrosion proof and made for standard dimension high-breaking capacity fuses. When fitted with B.I.C.C. "E" Type Fuse Links maximum discrimination is achieved against sub-circuit fuses.

**SPECIFICATION**

All-Insulated Cut-Outs are made with single or double terminals, top and bottom, and are designed to take fuse links for 15, 30 and 60 amps.




*Write for Publication No.232T. It gives further information and details of types and sizes of B.I.C.C. All-Insulated Cut-Outs.*

*Cut-Outs and fuse links are available at all our Branches.*

B.I. Callender's

## ALL-INSULATED CUT-OUTS

BRITISH INSULATED CALLENDER'S CABLES LIMITED
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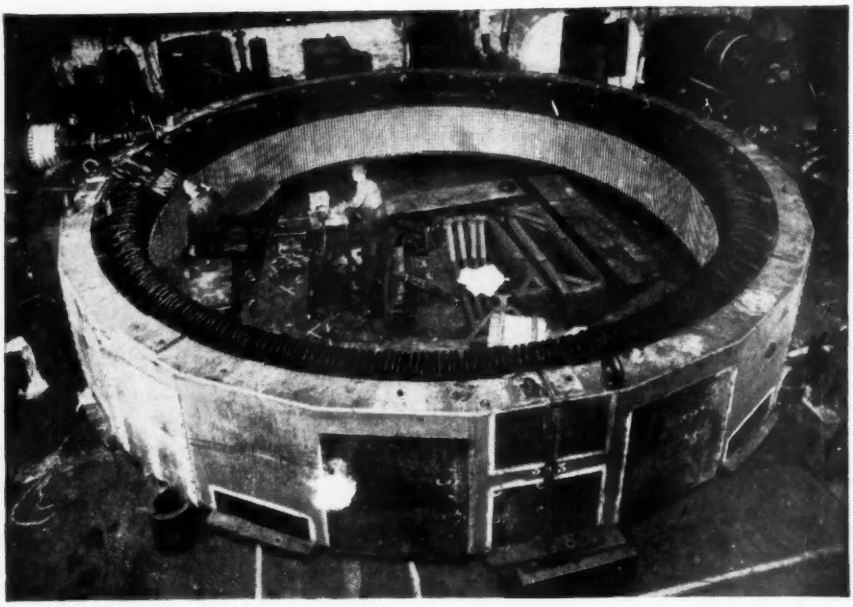

*Photo: Courtesy Metropolitan Vickers Electrical Co. Ltd.*
*One of the three water-turbine driven generator stators—the largest so far built in this country—for a New Zealand power station. Each coil consists of a number of "Fibreglass" insulated copper strips in parallel.*


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TRADE MARK

## — for Electrical Insulation
## Yarns, Tapes, Sleevings & Tying Cords

Experience has shown that substantial freedom from alkali is essential in glass textiles used for electrical insulation. " Fibreglass " yarn is substantially free from alkali and is **Electrical Insulation at its best.**

If insulation is destroyed, electrical equipment fails—valuable working hours are lost—important deliveries are delayed. The price of inferior insulation is a heavy one. Nothing but the best insulation available is good enough for your equipment. Since " Fibreglass " is made of glass, it is inorganic, acid resistant, and unaffected by corrosive fumes or heat—and since the glass is substantially free from alkali it is also unaffected by moisture.

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blackbirds baked
in a pie . . .

. . . all the
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Self-contained oven controlled by Thermostat · Independent Radiant Plate with 'Simmerstat' · Efficient Grill · Spacious Hotcupboard · It can be connected to a power point (13 amp.) · Interchangeable saucepan shelf which forms a hob when the cooker is not in use.

*Like all Jackson Cookers, the 'Giant' has a Guaranteed Low Fuel Consumption*

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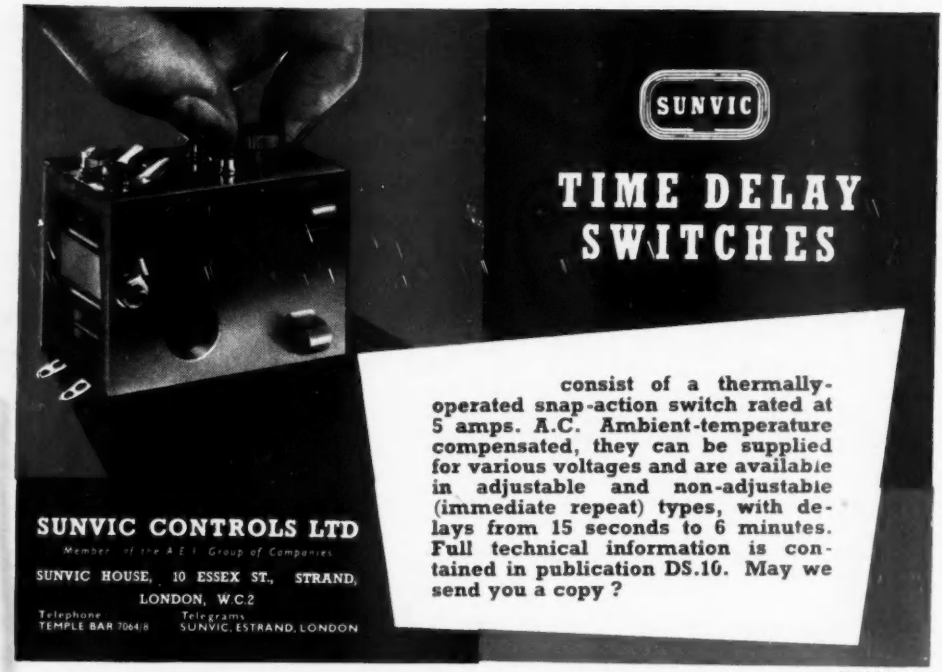
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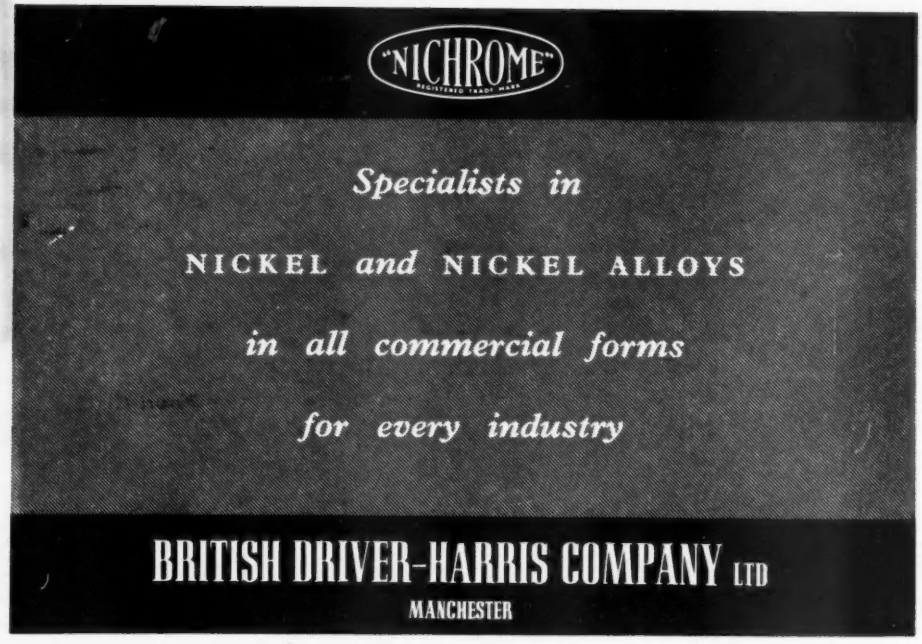
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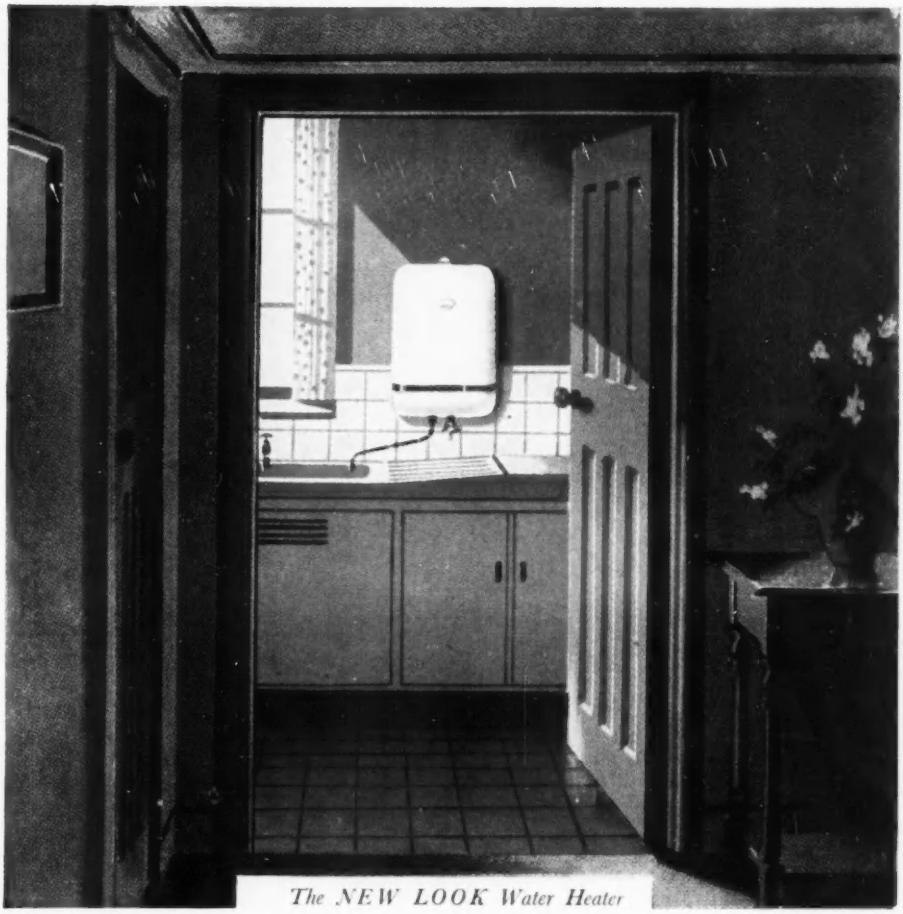

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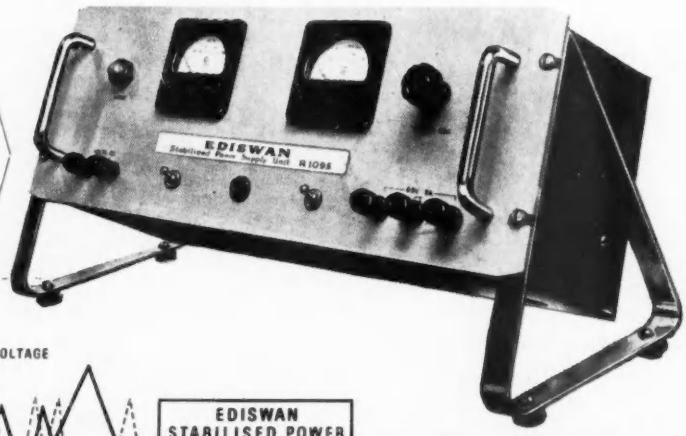
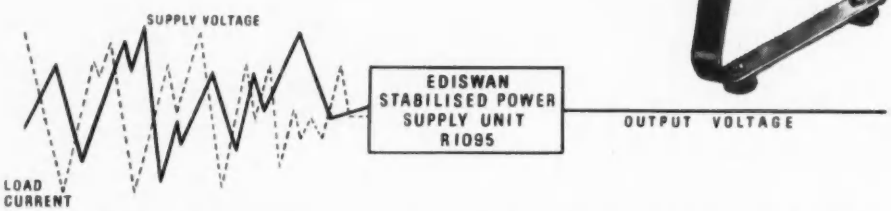
Plated Bench Stand **£1.1.0**




**Designed and developed as a result of many years experience in the design and use of Stabilized Power Supplies for research and test purposes, the Ediswan Stabilized Power Supply Unit R.1095 is an entirely new, low-priced constant voltage source.**

**Operating on 200-250 volts, 40-100 cycles A.C. supply it provides an adjustable 120-250 volts D.C. highly stabilized supply at 0-50 mA and a 6.3v C.T. 3 amp. A.C. unstabilized output for heater supply.**

**The stability is such that with mains change of 10v, output change is less than 0.1v. With load change of 0-50mA. output change is less than 0.1v.**

**Output resistance less than 2 ohms. Ripple approximately 2 mV.**

**The unit can be supplied with or without meters. Provision is made for the addition of meters at a later date.**

**The unit is designed for standard 19" rack mounting or for bench use. Plated bench stands as illustrated are available if required.**

**Further details are available on request.**

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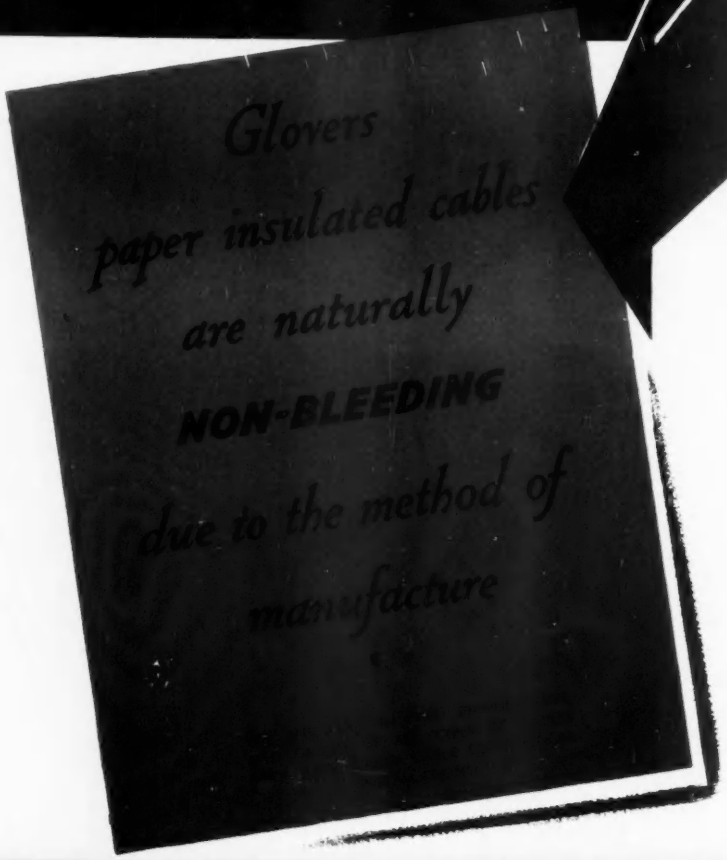


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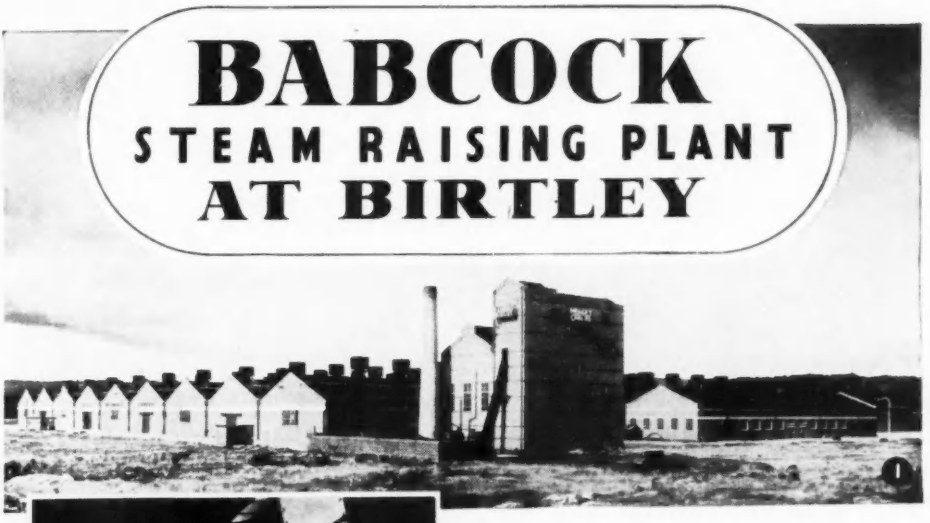
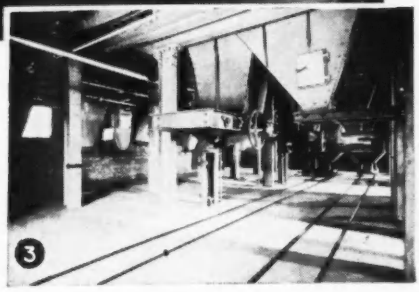
# BABCOCK
## STEAM RAISING PLANT AT BIRTLEY





The new Birtley Works of W. T. HENLEY'S TELEGRAPH WORKS COMPANY LIMITED are an example of the most up-to-date factory layout and incorporate the best modern equipment, including BABCOCK steam raising plant.

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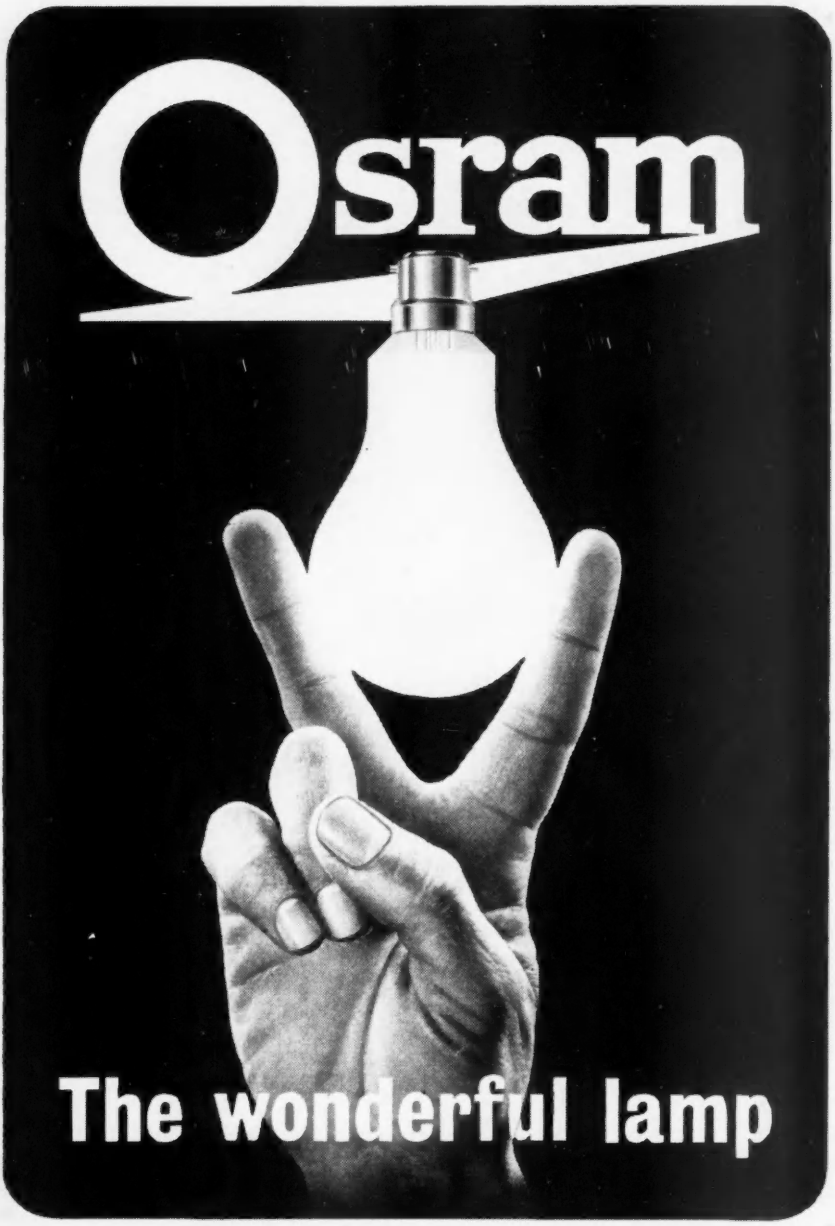
*This installation, one of a number carried out by BABCOCK & WILCOX, LIMITED, at the various works of this world-famous firm of cable makers, is a tribute to the excellent performance of BABCOCK boilers and to the comprehensiveness of B. & W. service.*

1 Henley's Birtley Works with boiler house in the foreground.
2 The three Babcock boilers. A view of the firing aisle.
3 Basement, showing hoppers and wagons for ash disposal.

STEAM

BABCOCK & WILCOX LIMITED, BABCOCK HOUSE, FARRINGDON STREET, LONDON, E.C.4

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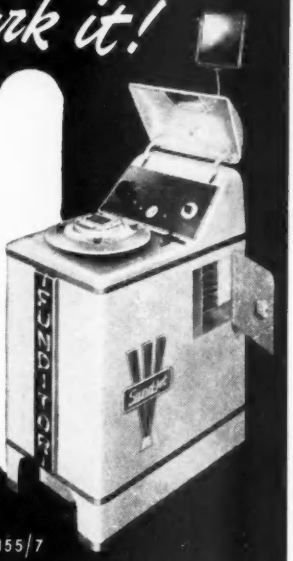

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Designed for indoor use by Supply Authorities and Industrial Consumers, type O.L.X. air-insulated oil circuit-breakers are available up to 800-amps. rating and are A.S.T.A. certified for breaking capacities up to 250-MVA.

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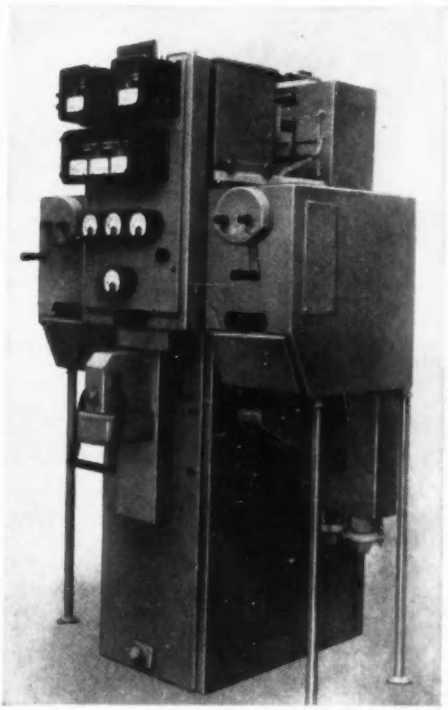

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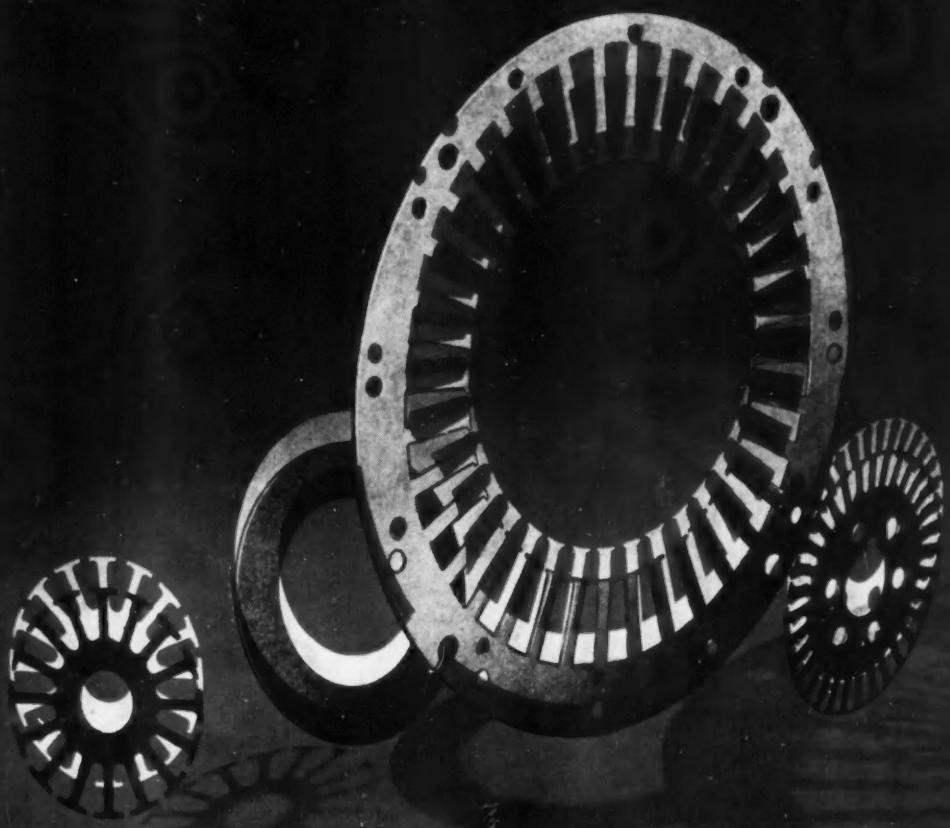
# Electrical

## STEEL STAMPINGS



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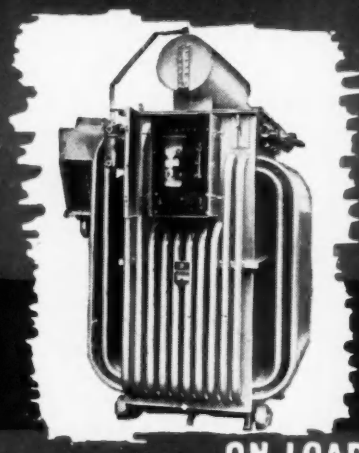

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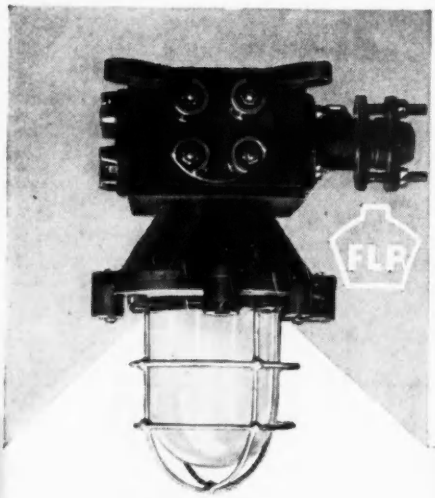


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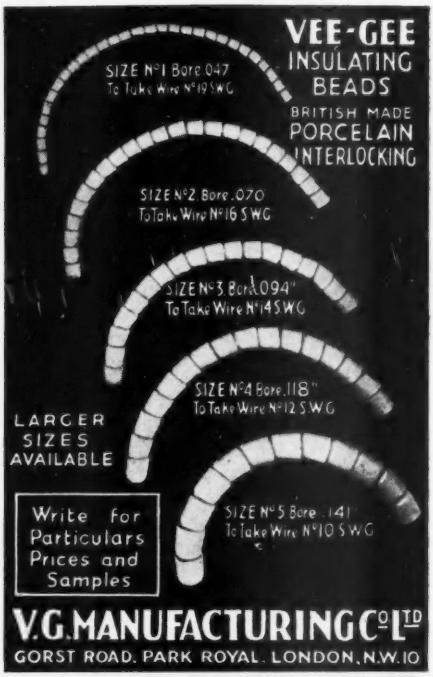
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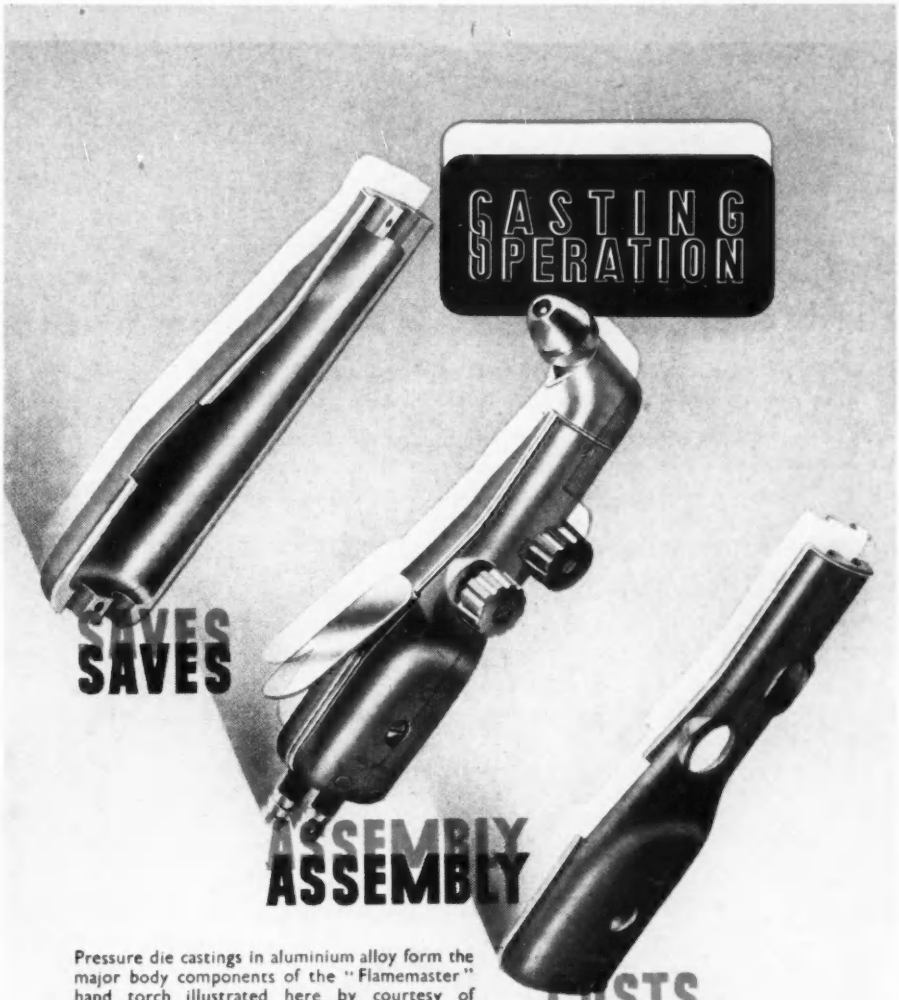


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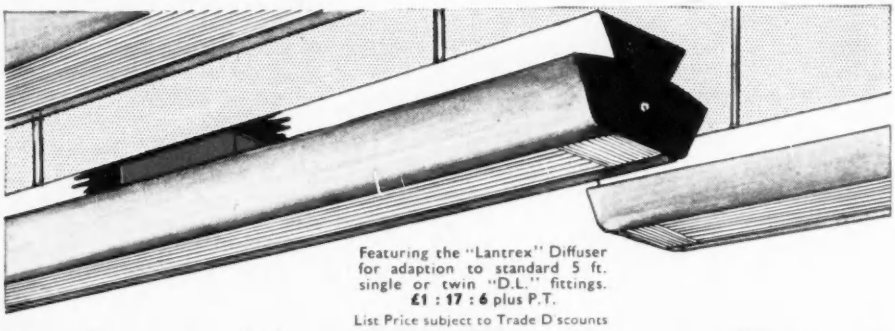

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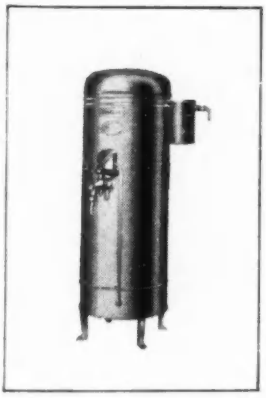

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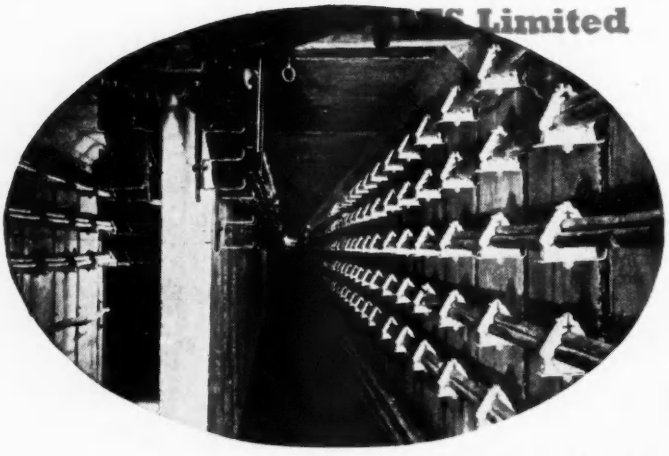

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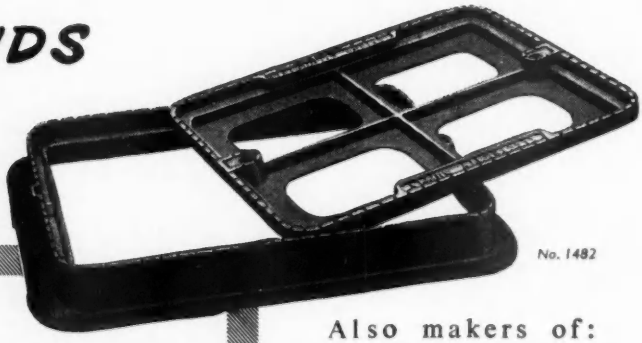

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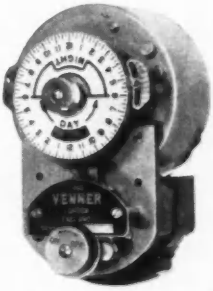


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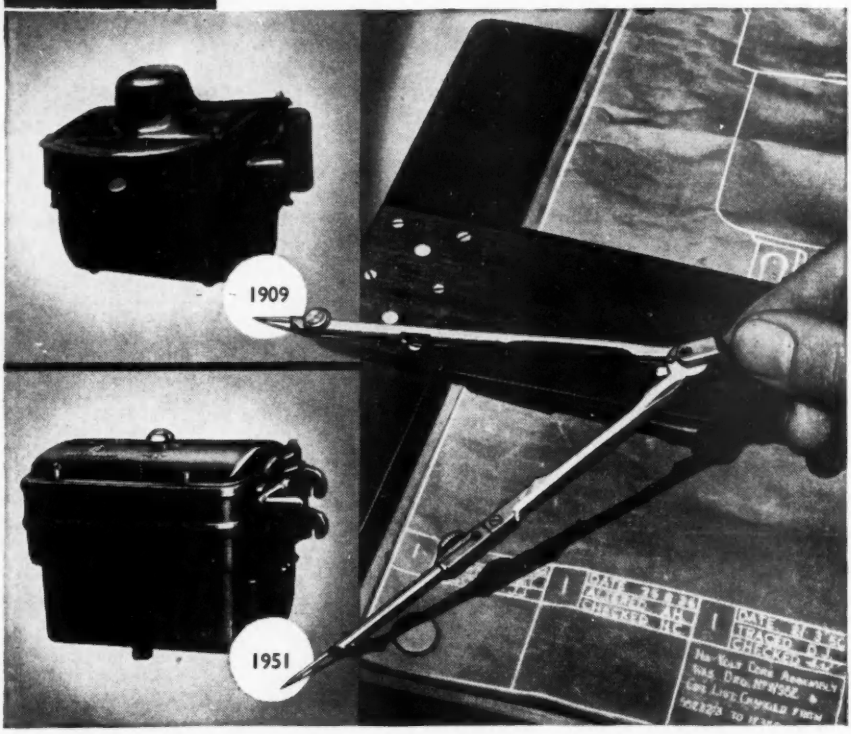


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ELECTRICAL TIMES

Vol. 120 No. 3122 THURSDAY, 6 SEPTEMBER, 1951

PUBLISHED EVERY THURSDAY

SIXTIETH YEAR OF PUBLICATION

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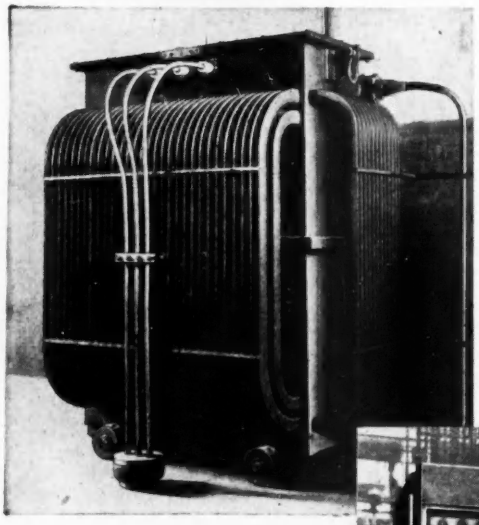

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# Editorial

### *SLIGHT IMPROVEMENT*

AFTER the dark night of despondency that has been marked out by most of this year's public utterances on the subject of electrical supply, any faint glimmer of a more hopeful dawn is likely to arouse enthusiasm disproportionate to its true importance. So first thoughts on the reported softening of the Treasury attitude to the British Electricity Authority's importunity for permission to expend more on capital works must be guarded. Only the area boards seem affected by the present relaxation, and their hopes are confined to anticipation of permission to spend a little more money on the extension and reinforcement of their distribution systems. There is, however, a general feeling that this will remove the worrying restrictions on the connection of large blocks of would-be domestic consumers, which threatened to build up so awkward a legacy for future years. Probably the most heartening feature of this small episode is the suggestion it contains that sustained pressure can do something to persuade economic planners that they are not always right first time. No doubt those concerned will return to their requests for larger concessions with renewed hope and increased energy.

### *LEARNING TO CONTROL*

IT is a well-established complaint of engineers and scientists that the higher positions in industry go to the accountants, lawyers and the like, rather than to themselves. Lord Hankey, speaking last week, put the other side of the problem. He dwelt on "great blocks of science and technology . . . whose higher direction called for a special type of scientific and technological administrator, not always easy to find." His solution for this shortage entails the setting up of a staff college, somewhat on the lines of those run by the Services, which would train the specialist scientist in the arts of administration, not by directly teaching him some facts, but rather by encouraging him to think around the subject on the basis of his experience. The comparison suggests that the organisation Lord Hankey desires exists already, for three years ago the Prime Minister characterised the Administrative Staff College, Henley, as the "civil equivalent of the Imperial Defence College." If engineers and scientists with the requisite experience in the control of projects and people were nominated more frequently for the sessions there, then any narrowness arising from early specialisation should certainly be erased. Founding a special organisation for those with primarily scientific attainments seems a retrograde step in setting technologists and their kin apart.

### *MICROWAVE AND THE GRID*

IN this issue we publish a short summary of an article dealing with the relative merits of microwave and carrier equipment for power system communications. While at the moment little data are available on the economic factors involved, nor is there much information on operating reliability, there are good grounds for believing that microwave is the better system where many separate channels are needed, and where the transmitting and receiving points are not widely separated. Of all the systems in the world, the grid is probably the most intricate and most heavily loaded, and for integrated control there would appear to be an excellent case for the introduction, over certain sections at least, of microwave communication. That the B.E.A. is fully alive to the potentialities of this system is shown by the fact that experimental work is shortly to be carried out, possibly between the mainland and the Isle of Wight. With the ever-increasing loading on the grid the necessity for multi-channel working will become of great importance, and it is to be hoped that the experimental work will be pushed on as fast as possible.

## *APPROVAL TESTING*

CANADA's insistence on official approval for all apparatus connected to the public supply mains for long involved British firms exporting to that Dominion in expensive arrangements for testing and modification. The need to send samples to and fro across the Atlantic had the additional disadvantage of imposing long delays before manufacture could commence. It was with this background that towards the end of the first dollar crisis, in 1949, agreement was reached with the Canadian Standards Association for approval tests to be carried out in this country, the British Standards Institution co-operating. With the shift of events giving once more an adverse balance of payments, enhanced importance attaches to the report issued last week describing progress of the scheme. Test arrangements of this type have proved practicable in this country, and a valuable store of experience in the clarification of written rules has been assembled. Besides its immediate importance, this activity may prove a big factor in future developments. It is too seldom realised that the use of instruments, machines and accessories complying with relevant British Standards is a requirement of the I.E.E. wiring regulations. If these ever became widely embodied in legislation, some certification procedure would become necessary, and the experience gained would be invaluable.

## *SAFER STILL*

THREE points stand out in the sorry tale of last year's deaths in the home, traceable to electrical apparatus, which MR. SWANN has once more prepared as a warning to all concerned with wiring work. The first is the strange attraction which scissors have for women as a means of rather aimlessly probing sockets when trouble of some sort is suspected on electrical apparatus. Year after year scissors and knitting needles, used in this way, claim their quota of victims, and since the number of "near misses" must greatly exceed those which claim the coroner's attention, the time may have come for a publicity drive on the lines "if you must touch any electrical equipment, switch off first." The second of the three points concerns the old question—to earth or not to earth. In the case of electrical fires used in earth-free rooms, earthing is recognised as introducing a new hazard, and this year's tale of accidents underlines its danger. And the third point? That 44 fatalities is a small number to be suffered by some 11 million domestic consumers, but that with such a slight degree of extra care electricity could be demonstrated as being safer still.

## *THE BIRMINGHAM STORY*

QUITE apart from the fascination it holds out for the button-pressing tourist, the value of the Science Museum to the serious student can hardly be over-estimated. Its sole disadvantage is that being located in London, it is not readily available to those in other parts of the country. It is, therefore, a welcome piece of news that Birmingham is actually in process of transforming a disused manufacturing establishment into a permanent scientific and industrial museum to perform the same function for the industrial Midlands. It has been stated that industrial undertakings throughout the country will contribute materials and models for a wide range of exhibits which will be of assistance in explaining processes to the younger generation in industry. It is emphasised that the museum will also commemorate the achievements of Boulton, Murdoch and Watt. "Bremicham" was already a place of note when Leland reviewed industrial Britain in 1538, and the fact that between the middle of the seventeenth century and the passing of the Patents Act in 1852 its citizens took out more patents than those of any other city in the Kingdom, bears witness to the fact that it has fostered many good men in addition to its more famous names. It is but fitting, therefore, that it should commemorate their achievements in a manner which will inspire as well as instruct its younger sons. The Birmingham story, as it might be termed, will stand a lot of telling.

*Meteor*

# Wiring in Nigeria

## Native labour builds from scratch the University Town of Ibadan

by J. MELLANBY, M.A., A.M.I.E.E., M.Inst.F., M.I.H.V.E.

UNIVERSITY COLLEGE, Ibadan, Nigeria, was started as part of the scheme for Higher Education in the Colonies, in 1947; teaching actually commencing in January, 1948, when a number of students and much equipment were transferred to Ibadan from the old Government Higher College at Yaba, near Lagos. Initially students and staff were housed in wood buildings which were used during the war as a military hospital. By 1947 these were largely in a derelict condition, but repairs, alterations and extensions were undertaken by direct labour under the College's construction department. At the same time negotiations were in progress to acquire a permanent site of some five square miles north of the town.

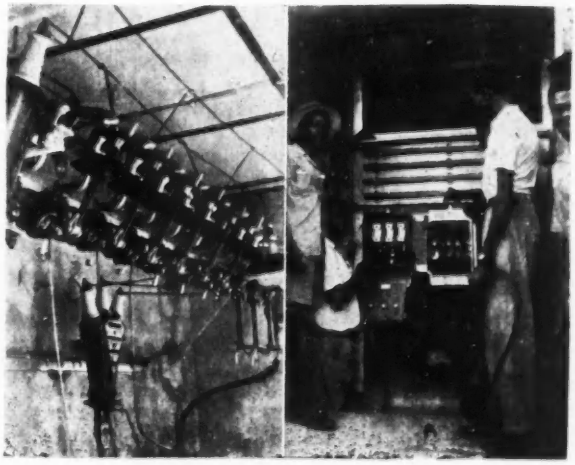
### *Rapid Growth*

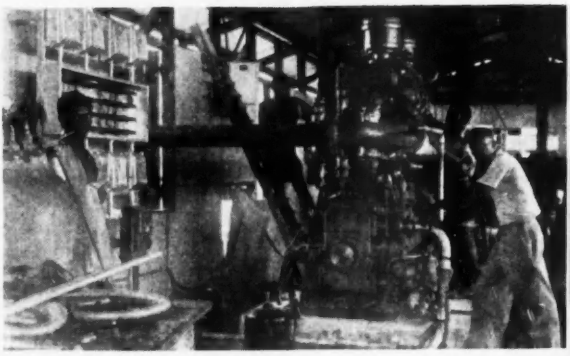
From the start the rate of growth of the College exceeded expectations. By the 1950-51 Session the number of students had reached 360 and the teaching and administrative staff 90. Further annual additions of about 100 to the student population are expected until 600 is reached. All these people, together with domestic servants, clerks, laboratory and maintenance staff, have to be housed, so the problem is really that of setting up a small town.

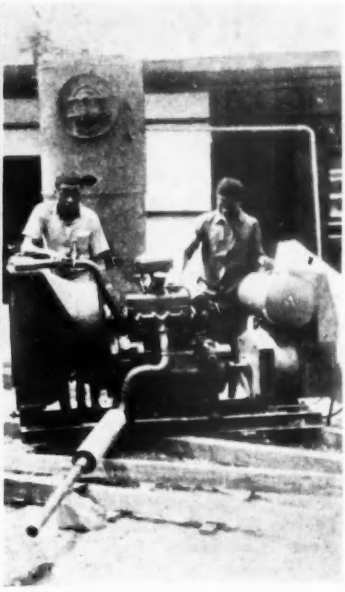
One reason for the choice of Ibadan as the University Town was that it was one of the few places in Nigeria with both water and electricity supplies. Unfortunately, when the College was established there it was found that the local power station was already overloaded, while the extensions, authorised during the war period, were delayed through protracted deliveries of material, so it was decided to start generation on a small scale. Two 20 kVA diesel alternator sets were ordered in November, 1948; there was some excitement when they did not arrive on the ship specified on the documents, but they turned up a few days later and were formally switched on by Dr. F. A. Ibiam, a member of the College Council and Legislature, on March 9, 1949.

Meanwhile a policy of setting up a department to carry out all electrical work by direct labour was pursued. Skilled labour does not yet exist in any quantity in Nigeria, and it was considered wrong to import expatriate mechanics and electricians, so likely men were recruited from the many thousands who came seeking employment. A simple system of tests for would-be applicants was devised covering literacy, natural manual skill, experience, etc. While no claim is made that this is more than a rough and ready substitute for the elaborate psychological tests carried out in more advanced parts of the world, it has produced a staff who, after gaining experience on the job and where as much instruction as possible was given by the consultant engineer personally, have produced some remarkable results.

*"D" fuses are used in the substations, and these, together with the aluminium-sheathed cables, are seen in the left hand picture. On the right jointers are connecting the l.t. panel in No. 3 substation*







*Largest generator on the system is the 200 kVA unit seen here in the course of installation. On the right, an electric welding set has been removed from the workshop for boiler repairs*

During these early months most of the wiring carried out was t.r.s. surface work in the temporary wood buildings. The first major trouble occurred when one of the alternators went down to earth, apparently as a result of having been soaked with sea water on the way out. The offending coil was located, and as insufficient wire was available locally to rewind the entire stator, it was decided to try to wind the one coil alone.

### *Emergency Repair*

In all some fourteen students volunteered to help, so, with an electrician at either side of the stator, they carried out a "Waltzing Matilda" act and kept the wire off the ground and free from kinks while it was threaded through. After varnishing it was stood in front of the radiator of the other set to dry out, no oven being available. Today, more than two years later, that set is still running for more than 12 hours a day, no trouble having been experienced with the alternator in the interval.

During 1949 it was decided to start a training school for nurses in connection with the medical faculty, some more semi-derelict army huts being obtained for this purpose, about three-quarters of a mile from the temporary College. An earlier proposal for an independent plant to supply this was turned down in favour of an overhead line from the College. This, incidentally, first forced the College into the manufacturing field. Insulator brackets, "D" irons and other ironwork were unobtainable locally, and deliveries from Britain were protracted, so, as both the wire and insulators were in stock, and local "Tik" wood poles were available, the job was started.

It was not the first time electrical ironwork had been made in Nigeria, but in all previous attempts "D" irons were made one at a time by a blacksmith, whose output was about six per day. As the workshop now boasted a fly press, a jig was made from scrap, the drawings being prepared by a student, and after a little practice a team of three maintained an output of 20 per hour. Initially all the bolts, stay rods, etc., were threaded by hand, but fortunately a power-driven screwing machine was soon purchased, and that drudgery eliminated. After manufacture, all the ironwork was thoroughly wire-brushed, and painted with aluminium paint, and has stood up quite well to the climate.

### *Second Power Station*

Meanwhile the permanent site had been surveyed and partially cleared, and power-driven plant for making concrete blocks for building was installed. This necessitated a second power station, to which the 20 kVA generators were transferred and replaced by 27·5 kVA sets of the same make. At one time the block-making was carried on continuously day and night. Later a well-equipped woodworking shop was installed, together with construction stores, offices, etc.

It had been decided that permanent University buildings were deserving something better than the normal local practice of overhead distribution and t.r.s. wiring installed on

the surface throughout. Underground distribution with paper insulated cables might be more costly, but it should at least avoid most of the lightning trouble prevalent in the tropics, as well as having an aesthetic value. To implement this, lessons were given in cable jointing, and a team of jointers was soon at work, to be followed a few months later by a second when the senior mate was considered sufficiently proficient to be promoted. There have been troubles with cables since, mostly mechanical damage when digging for drains, water, etc., and one short-circuit when driver ants entered a sealing chamber, and after a meal of empire tape and other insulating materials were cooked to death in a "potage" of bitumen. There have been no troubles due to faulty jointing. The first cables were lead sheathed and served, but it was thought that aluminium sheathing might have advantages, so a short length was installed in 1949. Since there was no apparent corrosion a year later it was decided to use this material more extensively.

## *P.V.C. Wiring*

Much thought was given to choosing a system for internal wiring to replace the surface t.r.s., which, although satisfactory electrically, is not particularly beautiful, and takes a lot of fixing on hard cement-faced walls and ceilings. Steel conduit was known to be unsuitable, as the high humidity caused condensation, which in turn caused rust which attacked the rubber insulation. Finally a number of houses were wired in aluminium alloy conduit and fittings, some with v.i.r. cable, and some with p.v.c. The second can be advocated for high-grade work in a tropical climate. Conduit wiring was a completely new job for the electricians, so it was particularly interesting to see how well some of them picked up the ideas involved.

By this time the mechanical workshop was well under way, and was equipped with $7\frac{1}{2}$ in. lathe, $1\frac{1}{4}$ in. drilling machine, hacksaw machine, shaper, electric welder, sheet metal guillotine and folding machine. A growing volume of "electricians' work" was carried out; this consisted mainly in drilling and tapping boxes at first, but finally bus-bar chambers and complete switchboards were being made.

## *Plant Shortages*

By 1950 it appeared that it would not be possible to vacate the temporary College as early as had been hoped, and that for some time to come both sites would be occupied. The demand for electricity went up, and still installation of the new plant in the Ibadan power station was delayed, so an independent programme of developments was decided upon by the College. It was decided to concentrate all generation on the permanent site, and to interconnect the two sites by an h.t. cable. A direct road was constructed, shortening the distance by over a mile, and cutting out two level crossings, the route of which would be followed by the h.t. interconnector and the water mains. It appeared that with the comparatively small amount of power to be transmitted, estimated at a maximum of 500 kW, that if a voltage of 11 kV was employed there were many advantages in using cable instead of overhead lines.

*Tents last only a short while in Ibadan, and the cable jointers seen below use a portable aluminium house. On the right, on 11 kV jointing is in progress beside a water main*

*Electric welding is being carried on inside the workshop in the left-hand view, while below electricians are busy assembling a switchboard*

Experience with the trial length of aluminium sheathed cable having been satisfactory, it was decided to adopt this material for the h.t. scheme, and the estimate of cost prepared showed that there should in fact be a small saving over the overhead line, especially as cable would have to be used in any case for two crossings of the Ibadan 6·6 kV lines and for a considerable distance at each end. In view of the small amount of power involved, and that the cable would only be 0·0225 sq in., it was considered unnecessary to go to the expense and complications of oil-filled circuit-breakers, etc., so "D" type fuses were used, but installed indoors in small substation buildings. In the same buildings were placed the l.t. boards, which also serve as barriers to prevent access to the h.t. gear.

An annoying delay occurred before the jointing of the h.t. cable could start, since the jointing materials had been lost in transit. Fortunately they turned up some three months later, just before the replacements arrived. It was a great day for the jointers when the first length of cable was made alive and there were no incidents.

### *Jointing Procedure*

Very soon about 1,000 yards were in operation, serving two substations on the permanent site, and enabling some excessively long temporary l.t. connections to be dispensed with, with a great improvement in voltage and regulation. The jointing of the main length of about 7,000 yards between the two sites presented some problems in organisation. A gang started from each end, who made the joint, fitted and plumbed the lead sleeve, filled it with compound and sealed off. This work was found to take 11 hours at first, and was gradually reduced to nine hours. There was not time during daylight in the working day to fit the c.i. box as well and fill with compound, so a third gang was organised to do this the day after the senior jointers had got as far as the sleeves. This enabled the work to proceed at the rate of two complete joints per day so that, after allowing for every snag, the whole length comprising 19 joints was completed in two weeks.

### *Cable Faults*

Although each length was thoroughly tested before jointing, there were two faults, one in the exact centre where a lump of rock had been dropped on the cable, and the second was more mysterious. There were several small streams to be crossed, where Everite pipes, suitably anchored in concrete were fixed to afford protection to the cable. At one of these the contractor responsible had tried to be clever, and used up a number of short lengths of pipe instead of a complete pipe. By some mischance the sheath was punctured at one of these joints, either by a tool or a sharp stone. When the first test was made the stream was dry, and the insulation was infinity. Later on there was

rain, and a test of 30,000 ohms was obtained; this was obviously unsatisfactory, but gave no indication as to where it was, so the power was applied, and after the generator fuses had been blown nine times it was reduced to a dead short between conductors, and a measurement of resistance located the place within 20 yards.

A new 200 kVA generator, ordered for delivery in September, 1950, actually started to arrive in March, 1951. Prior to that the original small sets had been augmented by a 60 kVA at the temporary College and a 50 kVA at the other site. As soon as the h.t. cable was completed it was found possible to improve the supply by running both stations in parallel. No difficulties were encountered, apart from the leading current which caused overheating in the generator switchgear and connections, but not apparently in the windings. As a temporary expedient it was found that things were all right with the switch and bus-bar covers removed to increase the ventilation! In the future this free power factor correction will be invaluable. As it is, the only time the machines have been pulled out of step was with one small generator only at each end of the line, when a 12 h.p. motor was switched on.

## Water Supplies

Water is obtained from the Ibadan town waterworks, but as most of the new site is above the reservoir a tower and pumps have been erected. The pump house, containing duplicate Mather & Platt centrifugal pumps driven by 10 h.p. motors, is combined with one of the sub-stations. This is about 1,000 yards from the tower, so, in order to avoid long pilot wires,

**TABLE 1—ENGINEERING STAFF EMPLOYEES**

| | |
|---|---|
| Inside Foreman ... ... ... ... | 1 |
| Outside Foreman ... ... ... ... | 1 |
| Mechanics and Power Station staff ... | 24 |
| Wiremen and Mates ... ... ... | 11 |
| Cable Jointers and Mates ... ... ... | 6 |
| Overhead Linesmen (Power and Telephone) and Cable Layers ... ... ... ... | 13 |
| Plumbers and Mates (including Gas men)... | 13 |
| Rock Drill Operator... ... ... ... | 1 |
| Clerks (one acts as Meter Reader) ... | 2 |
| Driver ... ... ... ... ... | 1 |
| Labourers ... ... ... ... ... | 8 |
| Total ... ... | 81 |

control is being installed to work on a quick-acting ball valve on the outlet of the pumping main, and a pressure switch. A second pressure switch is fixed to prevent the pump operating if the head on the incoming main drops below a certain value, indicating that the town reservoir is empty.

During the period under review most cordial relations have been maintained with the local public utility services, both electricity and water. Material, always in short supply, has been exchanged in both directions to such an extent that the final settling up was in danger of becoming an accountant's nightmare, and the College has both given and received help with labour.

## Engineering Staff

In September, 1948, the engineering staff consisted of one electrician and one plumber. Its present strength is given in Table 1.

A brief summary of the main construction work carried out during a period of 33 months is as given in Table 2. This covers completed work only : there is, in addition, a considerable amount in hand.

**TABLE 2— DETAILS OF ELECTRICIANS' WORK**

| | |
|---|---|
| H.T. Cable Laid and Jointed ... ... | 9,000 yards |
| L.T. Cable (Mains) Laid and Jointed | 3,400 ,, |
| do. (Services) do. | 3,000 ,, |
| L.T. Overhead Mains ... ... ... | 5,000 ,, |
| Substations completed ... ... ... | 4 |
| Lighting and Plug Points wired. t r.s. | 2,320 |
| do. do. Alloy Conduit | 1,336 |
| Total | 3,656 |
| Motors (1 h.p. and over) ... ... | 35 |
| Fluorescent Lamps ... ... ... | 163 |
| Street Lamps ... ... ... ... | 40 |
| And the following non-electrical work: | |
| Water Mains (2 in. to 8 in.) ... ... | 5,100 yards |
| Gas Mains (Who said "Shame"?) ... | 250 ,, |

The above only represents part of the activities of the Department. In addition, laboratory equipment has been made and repaired, refrigerators and other appliances have been maintained, and large quantities of bolts, nuts and other metalwork manufactured for the Construction Department. Supplies of timber were assured by carrying out urgent repairs for the sawmill, which might otherwise have been out of commission for a protracted period, and some of the men gave up a week-end to install new generators at a nearby Methodist Mission Hospital.

## Present Position

Since the article was written, schemes for direct labour construction and installation at the University have been abandoned, but the experience gained in the years of working have shown what can be done in this way, starting from scratch. The author, with many of the men written about in the previous pages, plans, however, to continue to carry on an electrical engineering practice in a country where so much success has so far been achieved.

# Accidents in the Home

## HOME OFFICE SUMMARIES REVEAL SOME COMMON FAULTS

FATAL accidents in the home involving shock from electrical circuits totalled one more during 1950 than in the previous year, according to information issued recently by the Home Office, and summarised in the table that accompanies this article. In addition to the 42 deaths resulting from electrocution, there were a further 27 known cases where fatalities resulted from clothing being set on fire by inadequately guarded electric radiators. This latter figure compares with 35 in 1949.

Details of the accidents again show that the neglect of elementary safety precautions is the outstanding reason for their seriousness. Widespread publicity for instance has been given to the dangers of using portable electrical appliances for heating bathrooms, where earthing of the human body is all too easy, yet six people, were killed through ignoring this advice, or not knowing of it. In three cases, the appliance concerned fell into the bath water, while in two others the radiator or its lead was faulty. In the remaining case, a youngster grasped a plug, connected to a lighting fitting, which was left lying around when the appliance it served was temporarily removed.

### *Dangerous Scissors*

Accidents with appliances again emphasise the fact that uninstructed women—and some men—insist on regarding scissors, knitting needles or penknives as the appropriate tools for probing the socket contacts of appliance connectors. Of the ten cases noted in the précis issued by the Home Office, seven have this dangerous trait as a factor. In five of these seven instances, failure to take the elementary precaution of switching-off was another contributory cause; in the other two cases the wiring of the house with switches in the neutral conductor made switching-off ineffective. The remaining three fatalities showed less evidence of gross carelessness, faulty workmanship in wiring being a principal cause.

All three portable tool fatalities were caused by the metal casing of the tool becoming alive. In two of these instances the earth wire of the tool was connected to the live line by mistake, while the third involved a home-made inspection lamp inside which a connection came loose. A brass lampholder and a wet basement floor provided the other links necessary to a fatal accident.

Seven accidents listed as being caused through faulty wiring include four where insecure wiring of connectors caused shocks after the flex had been pulled out. There was one case where a joint in a flex was insecurely taped, and was grasped by a man standing on a damp floor, and another where an earth wire in a three core flex was connected at the appliance end and at the other, left loose in a lamp connector, where it eventually touched the live terminal.

FATALITIES IN THE HOME

| | 1949 | | 1950 | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Bathrooms ... ... | 8 | 20 | 6 | 14 |
| Electric Irons, Kettles, etc. ... ... | 9 | 22 | 10 | 24 |
| Electrically operated tools ... ... | 2 | 5 | 3 | 7 |
| Faulty wiring ... | 6 | 15 | 7 | 17 |
| Electric fires (electrocutions) ... ... | 5 | 12 | 6 | 14 |
| Miscellaneous ... | 11 | 27 | 10 | 24 |
| | 41 | | 42 | |

The remaining instance is particularly interesting. A householder was electrocuted in the space under the roof of his house. Although he had taken the precaution of switching off the whole of the electrical installation at the main switch, the whole of the electrical metalwork was live because of a defect on the supply side of the main switch. Thus, although the latter was open, its protecting case was live, and as the earthing was ineffective, connected metalwork also became live.

Accidents attributable to electric fires include four in which single pole switches connected in the neutral were the primary cause, the element of the fire being alive when apparently switched off. In most of these cases the fact that the frame of the fire *was* earthed provided the additional hazard which led to a fatality.

Finally, the ten "miscellaneous" accidents emphasise the inherent dangers of all flexibles —they may become frayed, and their length takes them into unsuitable places. There is also some emphasis on the fact that earthing, if attempted, must give a good substation earth —domestic installation loop conductivity if safety is to be ensured.

# Our readers' views . . .

## Australian Trade

BEING an Australian connected with the electrical industry, I was interested to read Mr. Sperryn's letter on the above subject in your issue of August 23.

He claims that the Australian manufacturer is protected by 25% difference in exchange, freight, duty, etc., totalling about 70%. He neglects to point out that he is compelled by law to pay a labourer more than the majority of tradesmen earn in this country (not to mention your junior engineers). Should not we, therefore, point at you, as the Lancashire textile people do at Japan, and talk of cheap labour? This difference in wage levels nullifies any advantage gained by Mr. Sperryn's method.

As to the trade associations with restrictive practices, are they absent in this country? Also, I think he will find that the subsidiaries of the large overseas (British) manufacturers are leading members of these associations.

Knowing the quality of the products of Mr. Sperryn's main Australian competitors, and having seen the "quality" of a lot of English manufacture (vide the report sent to Britain by the S.A.A. on wastage of material in equipment shipped to Australia and which had no hope of approval; B.S.I. published this report, if I remember correctly), I can't help wondering if this is a not case of "sour grapes."

BIRMINGHAM *Sydneyite*

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## Earth Both Ends

TO my mind, in your issue of August 16, 1951, under the heading "Problems and Practice in Engineering," your correspondent R. H. G. Holloway has brought forward an interesting point in connection with the earthing of conduit installations, a point which has, nevertheless, been often recognised and weighed, together with the consideration of the highest degree of safety to be obtained within an economic limit.

If such an installation be considered to take the form of a tree, then your correspondent, by requesting earthing points at top and bottom, adequately provides safety measures to cater for the instance of a break in continuity on the trunk of the tree. If, however, he intends to provide adequate earthing in all instances of breaks in continuity, then he must be prepared to earth each and every branch of the tree at the end remote from the trunk. It is obvious that should an individual switch length of conduit be detached from its tee box, then a metallic switch at the end of the "drop" becomes a source of possible danger.

It is the old, old story that one must accept either the expensive but absolutely certain measure of safety or the reasonable degree of safety to an economic limit. The latter can be accepted with confidence if only more serious consideration is given, in many instances, to the need for regular testing of the installation.

Incidentally, multiple earthing points are worthy of consideration in "earthed" situations, such as bathrooms, provided they are bonded to a common point.

DEWSBURY, YORKS. *E. Asquith*

◆ ◆ ◆

## Uncertificated Engineers—A Tailpiece

RECENT correspondence in your columns on the above subject has rather annoyed me. Can it please be pointed out to your correspondents that there is a difference between a "certified" person and a "certificated" one. It is unusual for "certified" persons to practice at any profession—except, perhaps, politics.

*F. G. McDonald*
PIETERMARITZBURG, NATAL A.M.I.E.E.

◆ ◆ ◆

## State Approval

YOUR opening paragraph in "Overseas News" for August 23 issue is, I feel, rather misleading. The main schemes operating are—or were when I left—those in Victoria and New South Wales. Any article with Victorian approval was automatically approved—on application—in N.S.W. An article with N.S.W. approval had to be submitted in Victoria, but if accompanied by the New South Wales test certificate,

only a committee examination occurred.

The schemes in Queensland, South Australia and Western Australia were only then (1949) in their infancy. They all accepted test certificates from the two major approvals bodies; if approval from either of these was held, the new approval was semi-automatic.

If the new scheme you mention is the one that was being formulated in 1949, its aim is to produce a uniform system of approvals, as the two main schemes were completely different. Victoria approved by sample, i.e., a sample was submitted and if approved by the Board was retained and the manufacturer was not permitted to deviate in the future manufacture from that sample—not even to change the colour of the handle of an iron ! N.S.W. operated a guarantee system, i.e., a manufacturer submitted an iron, say, and it was approved; he would collect the sample and sign a form guaranteeing that all future irons which he offered for sale would comply with the relevant S.A.A. approval and test specifications. He could then, if he so wished, scrap that design entirely, manufacture a new type of iron and, without reference to the Approvals Authority, offer it for sale. He was thus able to accept full responsibility for the safety of his product.

For further information, I suggest you contact the Standards Association of Australia, who produce these minimum safety specifications and who, in N.S.W., are responsible for the Technical Advisory Committee to the N.S.W. Approvals Authority.

*Australian Engineer*

# Review of Refrigeration Industry at B.R.A. Lunch

Achievements and problems of the refrigeration industry were reviewed by MR. R. H. LINE (Member of Council) at the British Refrigeration Association's lunch on Friday last, in proposing the toast of "The Eighth International Congress of Refrigeration."

Acknowledging the debt which the industry owed to the scientists and technicians attending the conference, Mr. Lines reviewed the progress made since the last conference was held in London in 1924 not only on the technical side, but in volume of business and in exports which for 1950 were more than 50% more than 1949 and over double the figures for 1948. Nevertheless this valuable industry did not receive the encouragement it deserved. Steel supplies represented a very serious threat to continued exports. World food spoilage due to improper storage was sufficient to feed a country the size of Britain, and refrigeration was no luxury, but a necessity to modern industrial survival. He appealed for a more equitable allocation of steel.

Response was made by MR. A. G. BOTTOMLEY, O.B.E., M.P. (representing Sir Hartley Shawcross who is an honorary president of the Congress), who referred to rise in import costs and the shortage of steel. Referring to the introduction of an allocation scheme, he pointed out that although it would not necessarily produce more steel it would achieve more equitable distribution. The new Abbey Works would, he hoped, ease the situation somewhat. In conveying the Government's awareness of the need for technical progress he instanced their establishment of the National College for Heating, Ventilation, Refrigeration and Fan Engineering at the Borough Polytechnic. SIR NORMAN KIPPING, J.P., in proposing the toast of "The British Refrigeration Association," drew a parallel between the old Guilds and Livery Companies and the modern Trade Associations, and the way in which they performed for their industry the functions of M.P.s with their constituents, and the valuable service performed by the B.R.A. for the industry.

In reply, MR. E. G. BATT (director and secretary, B.R.A.) acknowledged the assistance received from the officials of the various Government departments with which they were constantly in touch. Regarding the industry itself, Britain was now second only to U.S. as the world's largest exporter of refrigeration plant, and of its £24½ million production in 1950, £10 million had been exported. In spite of this, it was being pressed to increase exports, while its home market—so essential as a foundation for export trade—was being crippled by an increase in purchase tax to 66⅔%.

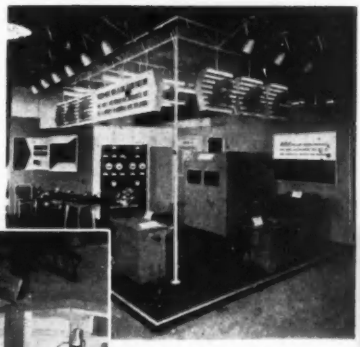
Another problem was the Governmental attitude to price maintenance—after appointing the Lloyd Jacob Committee, it appeared to disregard its recommendations. Manufacturers of refrigerators were in free competition with each other, and their products were "capital" goods and not over-the-counter products. If resale price maintenance amongst distributors were forbidden, the public in addition to the distributor—and his skilled staff of maintenance men—would eventually suffer if the stability, confidence and fair dealing in the industry were eliminated by "jungle trading."

The toast of "The Chairman" was proposed by Mr. N. F. T. SAUNDERS (member of Council), MR. A. E. LEACH, chairman of the Council, made suitable reply.

# *Stands at Olympia*

## PRODUCTS ON VIEW AT THE ENGINEERING, MARINE AND WELDING EXHIBITION

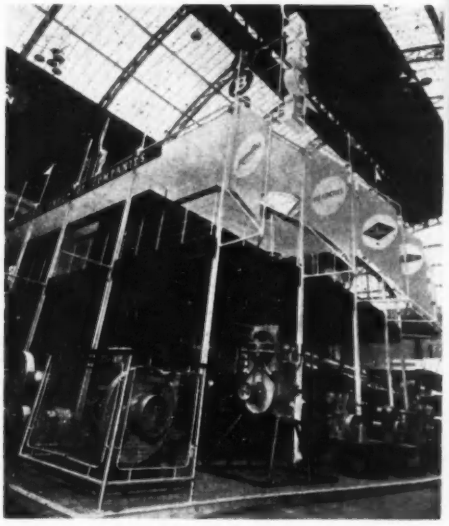
EXHIBITS of electrical interest at the Engineering, Marine and Welding Exhibition were described in last week's ELECTRICAL TIMES: this week we are able to publish views of some of the stands which are attracting electrical engineers at Olympia. The Exhibition was formally opened last Thursday by Engineer Vice-Admiral SIR HAROLD BROWNE, the Honorary President. Speaking at a luncheon held after the ceremony, Sir Harold characterised the exhibition as "an emblem really not only of our world renowned craftsmanship, energy and enterprise, but an emblem that the exhibitors and organisers had faith and confidence in the future of the country, a faith and confidence in spite of difficulties, without which the country would be in a bad way." Sir Harold was replying to the toast "Success to the Exhibition," which had been proposed by Mr. KEITH FRASER, President of the British Engineers' Association. In his speech, Mr. Fraser had reviewed the world wide trade of British Engineering concerns, and looked at present day opportunities.



*Views on the right and below show the stands of two cable making firms at the exhibition, Messrs. W. T. Henley's, and Crompton Parkinson respectively*

*The General Electric Co.'s stand, above, is to be found in the Welding Section of the exhibition*

*Brush, ABOE, below, and D. P. Battery Co., bottom left, are amongst the exhibitors*



# INVERTORS FOR INDUSTRY

## *Improved stability of d.c. network voltage during regenerative braking of motors*

OUR recent article on the occasion of the official opening of the Steel Co. of Wales' Abbey Works (ELECTRICAL TIMES, July 26, 1951), contained a brief reference to rectifiers on the 3·3 kV network which were provided with invertor bulbs for regenerative purposes—claimed to be the first of their kind supplied in the country. Through the courtesy of the Lancashire Dynamo Group of which the makers, Nevelin Electric Co. Ltd. are members, we are now able to give full details of this interesting application.

In large steelworks and similar situations, the regeneration during rapid braking of large d.c. motors provides quite a problem due to the voltage rise which occurs on the d.c. network. Hitherto the main method of limiting such rises has been the use of a loading resistor rapidly switched into circuit usually by electronic means (such as the firing of an ignitron). The use of an invertor, which permits the excess d.c. power to be returned to the a.c. mains not only results in a reduction of energy consumption, but provides far closer control of voltage rise during regeneration periods.

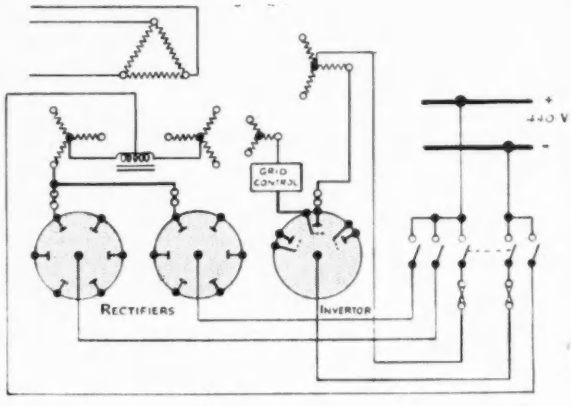



*Fig. 1 (above). Simplified schematic diagram of rectifier-invertor unit*

### *Operation*

The main connections of a combined rectifier-invertor equipment are shown schematically in Fig. 1. It will be seen that the invertor bulb "C" is connected to the busbars in opposition to the rectifiers A and B, the cathode being connected to the negative

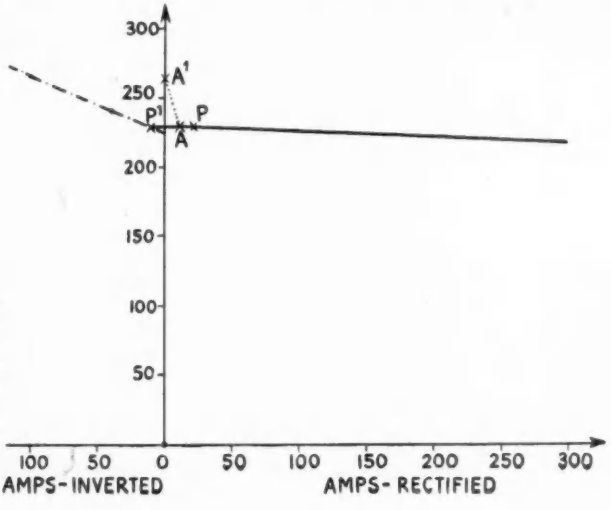
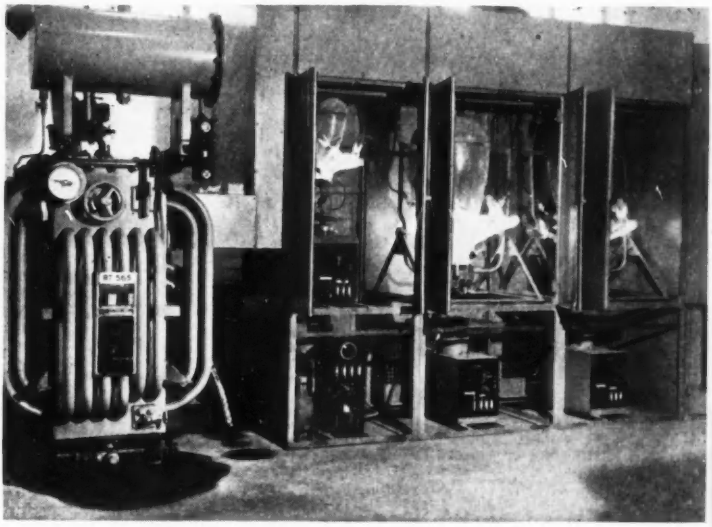



*Fig. 2 (on right). Typical characteristic of a 220 V rectifier-invertor unit. The dotted line from A to A¹ indicates the voltage rise which would normally occur if the invertor were not in circuit and the interphase reactor were unsaturated*



*General view of rectifier - invertor unit as installed in Abbey Works. The invertor cubicle is on the extreme right*

busbar and the positive to the neutral point of the invertor winding.

Typical characteristics of a 220 V d.c. equipment are shown in Fig. 2. The full line on the right hand side of the zero ordinate follows the normal regulation of a 6-phase rectifier while the broken line A-A$^1$ indicates the voltage rise which normally occurs at light load when the interphase reactor is unsaturated. This rise only occurs if the invertor is not in circuit. The invertor characteristic is shown by the full line to the left of the zero ordinate and its regulation is approximately equal to that of a rectifier of corresponding kVA output. The ratio between invertor and rectifier regulation determines the wattless circulating current at no load and for the example shown the range within which the circulating currents occur is indicated by "p" and "p$^1$". For a voltage on the busbars in excess of the designed no-load voltage the amount of current which will flow is determined by the invertor regulation characteristic, e.g. at 250 volts d.c. 65 amps. will be absorbed by the invertor whilst at the same time the load on the rectifier will be less than 5 amps. In fact, under no-load conditions the invertor circulating current has the effect of stabilising the busbar voltage, so that it cannot exceed a predetermined value (see Fig. 3).

## *Theory of Operation*

An appreciation of the way in which d.c. energy is absorbed by an invertor is simpli-

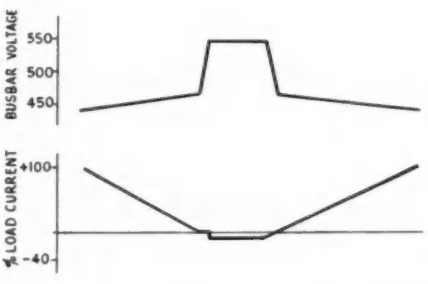



*Fig. 3a. Busbar voltage variation with falling load —invertor out of circuit. Note the sharp rise in voltage which occurs as the load falls off to zero*

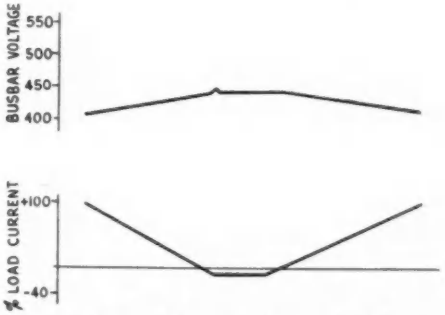



*Fig. 3b. Busbar voltage with falling load, invertor operating. Note flattened characteristic and small percentage increase as compared with Fig. 3a*

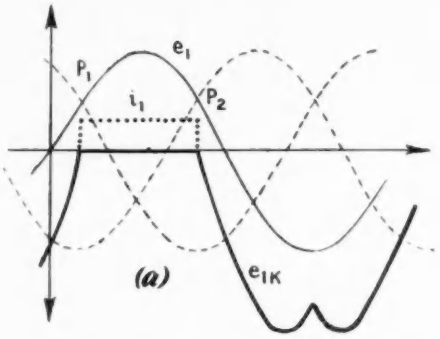



*Fig. 4a. Theoretical voltage-current characteristic of straight rectifier*

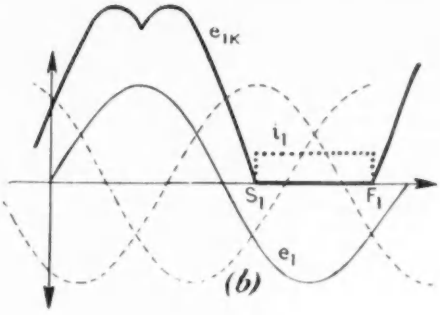



*Fig. 4b. Theoretical voltage-current characteristic for inversion*

fied by comparing the operating of a rectifier and an invertor as shown in Fig. 4. Fig. 4(*a*) indicates the voltage and current characteristics of a straightforward rectifier. Energy transfer from a.c. to d.c. follows, because current $i_1$ and voltage $e_1$ are in phase between points $P_1$ and $P_2$.

As the current in a mercury arc rectifier is unidirectional, in order to reverse the energy flow, the current must be delayed 180°, referred to the transformer voltage, so that it coincides with the period of negative voltage as shown in Fig. 4(*b*). This illustrates the theoretical maximum input for invertor operation, but in practice it is not possible to reach this maximum loading condition on account of additional electrical stresses inherent to invertor operation. Since the voltage between each anode and cathode in this case is entirely on the positive side, the anodes are capable of firing throughout the whole period, and in order to avoid this, negative grid bias and a proper grid design must secure a complete lock-out of the anode except during the interval between $S_1$ and $F_1$.

In order to eliminate re-ignition even with a strong negative bias the anode systems used in practice require a certain time to elapse between the cessation of current flow and application of a positive voltage. This time is usually called the 'de-ionisation' time; and it is essential for invertor operation to keep the anode voltage negative during the 'de-ionisation' time.

Fig. 4(*d*) shows that by advancing the firing of the invertor compared with the theoretical maximum shown in Fig. 4(*b*) a period of negative anode voltage between F and $F_1$ occurs, after the current ceases. This negative part of the anode voltage is the equivalent of the positive anode voltage which occurs before delayed firing of grid control rectifiers.

The theoretical current wave shapes in the curves (*a*)-(*d*) of Fig. 4 are of rectangular form. Apart from the perfect smoothing, this implies an instantaneous changeover from one anode to the other. In practice the leakage reactances of the transformers and the reactances of the supply system and anode chokes produce overlapping which is responsible for the main part of rectifier regulation. With invertors a similar overlapping occurs also resulting in an extension of the firing time of each anode. A safety margin is required to ensure stoppage of current flow.

These considerations show the importance of precise and consistent timing of the period during which current is permitted to flow and demonstrates also the value of applying to the grids a firing pulse of steep wave front, short duration and high peak voltage. By employing such pulses more effective use can be made of the half cycle during which inversion is possible, and invertor capacity employed to maximum advantage.

A large safety margin was selected deliberately when designing the equipment to provide reliable operation even under overload conditions which might vary considerably from those specified. When invertors are designed for operation at loads continuously approaching their maximum capacity it is usual to employ a somewhat smaller safety margin with consequent improvement in power factor.

## Construction

Three equipments have been supplied, one rated at 200 kW 440 V d.c., and two rated

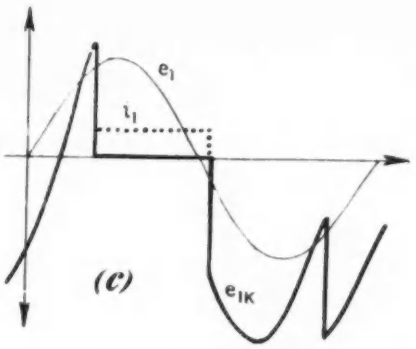



*Fig. 4c. Voltage-current characteristic of grid-controlled rectifier*

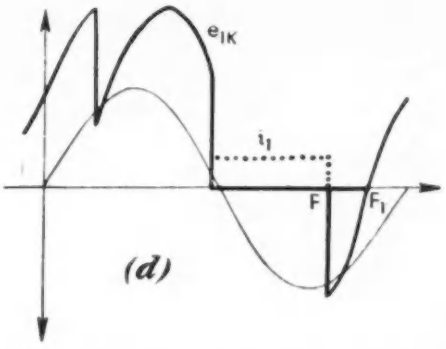



*Fig. 4d. Voltage-current characteristic of invertor*

at 300 kW 220 V, all operating from a 3·3 kV 3-ph. supply. The 200 kW 440 V unit has two rectifier bulbs with a total rating of 455 amps. and a 40 amp. invertor bulb. Each of the two 300 kW 220 V units has four rectifier bulbs with a total rating of 1,370 amps., and an 80 amp. invertor.

The rectifiers are standard Nevelin 6-anode bulbs, each forming, with its cooling fan, anode reactors and h.r.c. fuses, a self-contained unit, which are assembled in banks. The invertor bulbs, being smaller than the rectifiers, are housed in special cubicles designed to match the rectifier cubicles in appearance and providing space in which to accommodate the grid control gear.

Separate d.c. switchboards with the usual indicating and metering instruments control the output from the rectifier/invertor banks. Isolating switches are provided on the d.c. switchboard to enable rectifiers or invertor equipments to be isolated for maintenance purposes.

The transformers have a delta-connected 3·3 kV primary winding, and 6-phase double star secondaries, with a separate 3-phase winding for the invertors in addition to auxiliary windings for the rectifier ignition systems and cooling fans.

## *Performance*

A complete series of tests was taken on site to check precisely the phase angles at which firing commenced and terminated under operating conditions. The values observed agreed closely with calculations made when the equipments were designed and stable firing was readily maintained up to the limits obtainable on test.

Equipment No. 1 has been in operation for several months and has given satisfactory service. The smooth transition from rectification to inversion and vice versa is particularly noteworthy as it occurs without any sudden change of voltage at the threshold; of even greater importance is the voltage stabilising effect referred to earlier. In these respects the invertor is unique as it does not depend for its operation upon a voltage in excess of, or less than, the desired value. Another feature is the extreme rapidity with which the equipment operates. The delay for a change between maximum nominal ratings in the forward and inverse direction is only of the order of 1 millisecond, and is determined by the reactance of the system, so that the capacity for dealing with regeneration is available without additional delays due to the time required for operation of mechanical relays or electrically operated contactors, etc. The circulating wattless currents may be restricted to a very small value, whilst the no-load losses are negligible and the energy required for control is small, being similar to that required by grid controlled rectifiers. It is important to note that once the grid control unit has been set no further adjustments are necessary, nor should they in fact be made except within the limits specified by the manufacturers.

The experience gained from the operation of these installations has shown that there are no serious difficulties in the industrial application of glass bulb mercury arc invertors. The invertor can today be regarded as reliable as a straightforward rectifier and it will no doubt be widely applied wherever the characteristics of the load may call for absorption of reverse power, as, for instance, traction substations.

# FAULT LOCATION

## *Advantages of using the Fall of Potential Method in place of Murray's Loop for LV cables*

By J. G. BOGGIS, A.M.I.E.E., G.I.Mech.E.

A WELL-KNOWN method of cable fault location is the fall-of-potential which is similar in certain respects to Murray's loop. Both methods compare the resistance to the fault, with the resistance of a loop formed from the sound and faulty cores, and determine the fault position by simple proportion.

The essential difference is that Murray's loop is a null test, capable of great accuracy; whereas the fall-of-potential compares the readings of a milli-voltmeter having limited accuracy.

Fall-of-potential tests are, therefore, unsuitable for long cables as, to be useful, the location must be within a few yards of the fault. As an example, assume that the test error is 1% and that a tolerance of 4 yards is allowed, then 400 yards is the greatest suitable length; for longer cables Murray's loop is superior.

For high-voltage cables Murray's loop, using a rectifier as the source of h.v. d.c. supply, is pre-eminent. There remains however, a field in which the fall-of-potential test can be used to advantage: short lengths of l.v. cables.

### *Fault to Earth*

Consider the cable in Fig. (a): one core has a fault to earth but the continuity is not broken; a second core, which is sound, completes the loop. A battery, insulated from earth, supplies a current of 5-50 amps to the loop. The current is regulated by a rheostat and ammeter.

The falls-of-potential $V_1$ and $V_2$ are measured from earth (by earth is meant the metallic sheath of the cable) to the faulty and sound cores respectively. It is important to measure these potentials at the cable cores, and not at the current-carrying leads to the cores. Furthermore, the earth connection should not be changed during the test.

By proportion: $$\frac{X}{2L} = \frac{V_1}{V_1+V_2} \quad \ldots\ldots\ldots (1)$$

assuming that the sound core is equal, in length and section, to the faulty core, and that the test current is held constant. Sometimes L should be substituted for 2L in this formula, e.g., when $V_2$ is measured at the cable end remote from the battery; it will be obvious which should be used.

The test as described above fails in practice; the indicated location being false.

If the battery is disconnected, and the measurements $V_1$ and $V_2$ repeated, a more or less steady e.m.f. will be observed; this e.m.f. is usually due to electro-chemical action at the fault. This e.m.f. is in series with the true p.d.'s—added to one, subtracted from the other.

By taking the mean of two readings, with the battery reversed for the second, the disturbing e.m.f. is—providing it remains constant—easily eliminated. The correct fault position is then:—

$$\frac{X}{2L} = \frac{\text{Means of } V_1\text{'s}}{\text{Mean of } V_1\text{'s} + \text{Mean of } V_2\text{'s}} \quad \ldots\ldots (2)$$

Should the voltmeter reading not reverse polarity when the battery is reversed, the mean will be half the difference instead of half the sum. But this case is better avoided by increasing the test current until the true p.d.'s are greater than the e.m.f.

### *Fault Resistance*

The readings of the voltmeter are reduced by the fault resistance "f" ohms in the circuit of Fig. (a). If the voltmeter resistance is R ohms then, neglecting the resistance of the cable as insignificant, we have:—

$$V = E \frac{R}{R+f} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

where E is the voltage an open circuit i.e. the true p.d. Assuming that R and f are constant no error will be caused as the effect of the fault resistance cancels out in formula (2).

The assumption of constant R makes it imperative not to change the range of the voltmeter during the test. As a preliminary to the test, rough readings of $V_1$ and $V_2$ will settle the range, which should make the readings near full-scale deflection. There is no reason to suppose that the fault resistance will vary, as the test current does not flow through the fault but, so that the assumption of constant fault resistance is not strained, the range chosen should make R greater than f. These considerations will decide the minimum test current.

Interchanging the battery and galvanometer of a balanced Wheatstone's bridge does not disturb the balance. The new bridge is called the conjugate of the original, and though the balance conditions are unchanged, the sensitivity of the arrangements may differ. The concept of the conjugate bridge is a useful one in cable fault location, as if a test is found to have some practical snag, the conjugate connection will often remove it.

A fall-of-potential test made by interchanging the battery and voltmeter can be called, by analogy, a conjugate test, e.g. Fig. (a) becomes Fig. (e). This alternative test has certain advantages.

Since the fault is no longer in the voltmeter circuit, disturbing e.m.f.'s are unlikely—though not unknown with this connection. But the fault resistance is now in the battery circuit where it introduces two new difficulties:—

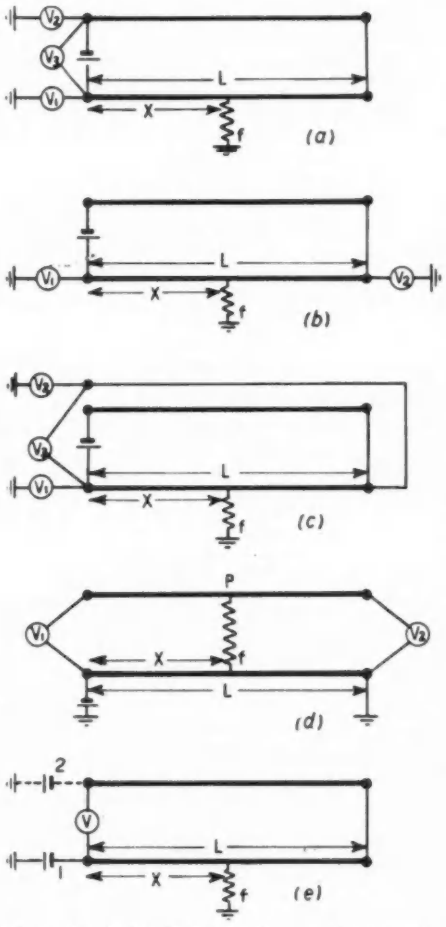
(*a*) It reduces the test current to a low value making the test insensitive.

(*b*) Variation of the fault resistance, owing to the heat generated by the current, makes it difficult to hold the current steady.

Because of (*b*) the current must be restricted, even when the fault resistance is low, as there is a risk of the fault-path burning out, making the location difficult.

Of course, very sensitive galvanometers are available to overcome the difficulty (*a*) above, but such instruments are troublesome to use. On the whole the advantage lies with the first test, Fig. (a), which allows a robust instrument to be used, and which does not require the accurate measurement of a few millivolts.

When testing l.v. d.c. mains by the second method, the test current can be conveniently taken from the public supply, through a controlling resistance.




*Schematic circuits of the various testing connections possible using the fall-of-potential method*

## *Further Tests*

In Fig. (b) is shown a useful variant of the first method, which differs by $V_2$ being measured at the cable end remote from the battery. This has the advantages that: (*a*) As the falls-of-potential are measured over the single route length, instead of the loop length, the possible accuracy is doubled. (*b*) The return core completing the loop can be of any section. (*c*) The loop connection at the far end need not be of negligible resistance; this is always a difficult condition to fulfil.

A further variant is shown in Fig. (c), which uses a test lead run out overground along the route of the underground cable. It has the same advantages as the previous method, and in addition, the sound core is provided by the test lead. Twin 7/·029 t.r.s. is recommended.

The error caused by the resistance of the test lead in series with the voltmeter will be insignificant.

## *Line-to-Line Fault*

Line-to-line faults, where two cores are in contact but insulated from earth, are easily located by fall-of-potential methods. One of the faulty, but continuous, cores is earthed at the far end, see Fig. (d), and the test current passes through the loop formed by one core and the cable sheath.

The falls-of-potential $V_1$ and $V_2$ are measured as before, taking the precautions against stray e.m.f.'s that have been outlined. Then the fault

position is given by formula 2, where L is the route length.

If the continuity of the sheath is poor the test current will be restricted. In this case the interchange of the battery and voltmeter—the conjugate test—may give better results.

Another modification is to measure $V_1$ and to compare it with the calculated p.d. per yard of cable; this is used when:—(*a*) one of the cores is burnt through at point "P" in Fig. (d). (*b*) The cable changes its section at the far end and equivalent length calculations are inexpedient. (*c*) The route length is in doubt, e.g. obsolete records. (*d*) A check is required on an indicated position.

A correction is required for the effect of the fault resistance in series with the voltmeter.

$$\text{Distance to fault in yards} = \frac{V_1}{Pd/yd.} \times \frac{(1+f)}{R} \ldots$$

(4) where f is the fault resistance, and R is the voltmeter resistance.

This modification can be used with any of the previous methods whenever it is more convenient, or as a check.

These tests are easily checked. The basic assumptions of the first test, Fig. (a), are: (*a*) that the loop is continuous, and (*b*) that the loop has a fault to earth at one point, and is insulated from earth at all other points.

Now $V_1+V_2$ is, when corrected for the resistance of the fault, the total fall-of-potential around the loop, which can be directly measured across the cable ends, i.e. $V_3$.

Therefore $(V_1+V_2)\ (1+\frac{f}{R}) = V_3$ or if $\frac{f}{R}$ is small; $V_1+V_2=V_3$.....(5)

Also from the known cable section and route length we can, as a further check, calculate $V_3$, which will confirm assumption (*a*) above.

Assumption (*b*) can be partly checked by opening the loop at the far end and measuring $V_1$ and $V_2$ as in Fig. (a). The ratio $V_1/V_2$ will approach zero if this assumption is justified.

Finally, if the voltmeter indications are not steady, or if the test results are not repeatable, there is good reason to suppose that the test is unreliable.

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# M. and I. Golden Jubilee

THE Micanite and Insulators Co., Ltd., celebrated its jubilee last month, and to mark the occasion Major W. I. Anderson, chairman of the company, supported by Sir Arthur Fleming, deputy chairman, made and received presentations on behalf of the directors in the main works recreation hall, when about 230 employees were present.

Mr. H. A. Cooper, general manager, opened the proceedings, and Major Anderson expressed regret that Major Stanley M. Mohr, managing director, was unable to attend, due to health reasons, but gave reassuring news of his progress. A telegram received from Major Mohr was read and one sent in reply.

Cheques for £500 were then presented by the chairman to both the Foreman's Association and the Micanite Sports and Social Club, and Savings Certificates valued at £55 to every employee who had completed at least 20 years' service. He next accepted on behalf of the directors a twin pen writing set from Mr. W. Stevens, chairman, Long Service Association, a silver cigarette box from Mr. W. Kear, vice-chairman, Foremen's Association, and two silver ash trays and a lighter from Mr. N. Underdown, secretary, of the Sports and Social Club.

Sir Arthur Fleming paid tribute to the founders of the company, whose products were still the main insulating materials. The new forms of energy under review would be used to generate electricity so that business would be forthcoming so long as technical superiority was maintained and the products of first-class quality delivered in time at an economic price, he said. Mr. D. J. Green, works manager, also added his tribute to the characteristic friendliness of the M.I. people, and hoped that the concern would continue smoothly on towards the centenary celebrations.

*Major W. I. Anderson presents Savings Certificates to Mr. W. Richardson, right, who served 50 years. At the microphone is Mr. H. A. Cooper, general manager*

*Notes on Wiring*
by MEGOHM

# Rising Mains

## *Requirements of an Electricity Board for Flat Installations*

I HAVE received a copy of the Southern Electricity Board's circular No. E.7.1, Series 2·4·48, which deals with the Board's requirements for rising mains and sub-services for blocks of flats, multi-occupier buildings, or buildings converted into flats. The Board states that in future all such installations shall comply with the requirements detailed in this circular. Information is given on provision of ducts and chases, technical details on rising mains, distribution equipment, fuses and earthing.

Statements in this document leave one in doubt as to who is to be responsible for putting into effect and meeting the cost of the Board's requirements. I quote for example: (1) In new buildings where rising mains are to be used suitable vertical ducts or chases must be provided, etc.; (2) The Board shall specify the size of rising mains and sub-services; (3) The type of consumer's control unit to be agreed; (4) Voltage should be maintained within the statutory limits at each consumer's supply terminals.

In connection with points 1, 2 and 3, surely the consumer, through his adviser (not necessarily the Board's engineer), shall decide whether vertical ducts or chases must be provided, specify the size of rising mains, sub-services and the type of consumer's control unit to be used, since presumably the consumer will have to meet the costs, as no indication is given in the Board's circular that they are likely to contribute to the cost of supply mains within buildings.

On the question that the voltage should be maintained within the statutory limits at the consumer's supply terminals, this, I would say, is a problem for the B.E.A. today and maybe for years to come.

I was interested to read that the maximum demand per flat for 20 flats per phase, after allowing for a diversity, was only 3 kW, and the minimum size for sub-services, it is stated, shall normally be 7/·064 v.r.i. cables in 1 in. conduits, which appears to be a very generous amount of copper to serve such loads.

Three types of rising mains and sizes of cables are recommended: (1) Solid copper bars; (2) Paper or varnished cambric insulated, lead or aluminium covered unarmoured cables (left bright); (3) Mineral insulated metal-sheathed cables.

It is also of interest to note the Board's current ratings for p.i. and v.c.l.c. cables, against which I have added the E.R.A. and I.E.E. ratings for comparison, from which it will be seen the Board have used the E.R.A. ratings.

| Cable | Current Rating in amps | | |
|---|---|---|---|
| P.I. or V.C.L.C. left bright | S.E.B. | E.R.A. F/T128 | I.E.E. Reg. |
| 2-core ·0225 ... ... | 89 | 89 | 71 |
| 4-core ·0225 ... ... | 76 | 76 | 62 |
| 2-core ·04 ... ... | 127 | 127 | 93 |
| 4-core ·04 ... ... | 108 | 108 | 86 |
| 2-core ·06 ... ... | 163 | 163 | 128 |
| 4-core ·06 ... ... | 140 | 140 | 112 |

Current ratings for p.i. and v.c.l.c. cables can be classified into 4 groups, depending on conditions under which they are installed: (1) Laid direct in ground; (2) Installed outdoors in free air; (3) Drawn into ducts; and (4) Used in and about buildings. It has generally been accepted for groups 1, 2 and 3 that E.R.A. ratings are applicable and for group 4, I.E.E. ratings should be adopted. It is, therefore, a departure from previous practice and it would be of interest to learn why the Board arrived at the conclusion the I.E.E. ratings are not acceptable.

It should be remembered that the current ratings given in the I.E.E. Tables are based on the ambient air temperature not exceeding 90° F., whereas E.R.A. ratings are based on the ambient air temperature not exceeding 77° F. and, therefore, the E.R.A. ratings should be multiplied by a correction factor of ·86 for comparison. No doubt the Board are desirous of giving assistance to the installation industry, but authoritative documents which are not clear and economic in outlook are a hindrance to progress. I would suggest that, if revision of the Board's circular is contemplated, it would be helpful if the Board clearly stated what they are prepared to do in providing services and from what point the consumer has to foot the bill.

# Power System Communications

## *Use of Microwave Equipment for Operation and Control*

THE use of microwave equipment for the transmission of control information has come rapidly to the fore in America during the past few years, and an interesting assessment of the relative economic and engineering aspects of microwave and carrier transmission has recently been published in the *Electrical World.*

### *Microwave Working*

Microwave working is carried out in the band 950 Mc/s to 30,000 Mc/s, allocated to the utility companies of America by the F.C.C. These frequencies require a line of sight from one aerial system to another with a clearance of about 50 ft above intervening objects. The wide bandwidth available permits the use of several voice and control channels simultaneously by "multiplexing." Two systems are in use : frequency multiplexing which divides the available bandwidth into several sections by using modulated oscillators and filters at differing frequencies, and time-division multiplexing where the signals of several input channels are sampled at a high repetition rate and successively sent over the microwave link, utilising full output for each sample.

The number of channels naturally varies with the equipment used. One 960 Mc/s equipment provides two-voice channels with multiplexing for telemetering, load control, supervisory control, and line protective relaying. Another 960 Mc/s equipment can provide up to seven voice channels by using frequency-division multiplexing of the single sideband type. Any of these voice channels can be broken up into several control channels by using audio-tone units. In the 2,000 Mc/s band a system giving 24-voice channels, any one of which can be broken up for control purposes, is available.

Thus the advantages of microwave transmission may be summed up as : provision of numerous channels between two points; freedom from man-made static or atmospheric disturbances; avoidance of interference from other nearby microwave channels and physical separation from the power line.

Several disadvantages are, however, inherent. The number of channels available means a serious interruption in the event of equipment breaking down, 100% standby is, therefore, required. Repeater stations are needed for long-distance working with additional possibility of breakdown. Reliable power supplies, both for main and repeater stations, must be provided, and these should be obtained from a source which will be unaffected by system failures. Maintenance may prove expensive.

The advantages of carrier working are also considerable, as power is usually drawn from the station battery and is, thus, largely independent of system supplies. The channels, too, are distinct and separate so that maintenance work or outage usually involves only one channel at a time, which can be tolerated on most of the utility systems. Finally, a carrier channel usually does not involve repeaters, all the equipment being installed in or at power plants.

Against this simplicity of working, however, are the facts that on many systems, carrier working has been carried very near the practical limit and in consequence users fear congestion difficulties if further channels are added. Weather conditions have a detrimental effect on carrier working, as sleet formation on lines increases the attenuation at carrier frequencies. Further troubles can arise when carrier working is applied to lines which include a cable section; the cable itself has a high attenuation, and losses occur due to impedance mismatch at the line/cable junctions. Lastly, changes in the configuration of the transmission system may require extensive changes in the carrier-current system.

### *Choice of Systems*

In view of the above comparisons, the choice between the two systems is largely dependent on the relative economics, together with the local operating conditions of the network. Thus, microwave tends to be suitable for cases where a large number of channels are required while for scattered networks where comparatively few channels are needed, carrier would be economically more suitable. In many cases, the cost of a single repeater station may well be the deciding factor. There seems to be, however, a definite place for microwave and a definite place for carrier, and they will supplement each other. At the moment, until microwave "unknowns" can be assessed by actual operating experience over a considerable length of time, it would be good sense to use microwave only over those sections of the system where it has large economic or operating advantages.

# Problems and Practice IN ENGINEERING

### *Wringer Roller*

I HAVE had an unusual fault on a well-known make of washing machine recently and I wonder if readers would be interested in my findings. The customer complained that she had to pull washing through the wringer to get her clothes, etc., dry. On examination, I found the wooden bearings were badly worn; new ones were fitted, but the fault persisted. My next check was on the gear-box, then I stripped the wringer away from the gear-box to check on the coupling and found everything in good order.

By this time I was getting rather puzzled; then, quite by chance, I noticed that where the shaft entered the rubber roller the rubber appeared to be spongy, and on examination it was found that the hexagon-shaped shaft just churned round inside the roller when a load was applied.

Much time had been wasted on checking the machine, whereas if I had known or even suspected it was possible for this type of fault to occur, I could have serviced the machine in a matter of half an hour.

Needless to say, a new roller was fitted and the machine worked perfectly.—*K. Wilson.*

### *Pyrotenax Installations*

EXPERIENCE has shown that provided certain precautions are taken a Pyrotenax installation can be lasting and in cases of surface fixing pleasing to the eye.

It is well known that copper is considerably hardened by constant working, therefore in running lengths of Pyro, the cable should be run out on the ground, cut to required measurements, and drawn in with the minimum of handling. It will then be found that the cable or cables can be clipped in straight runs using gloved hands without having to "beat" out "kinks," which practice mars the surface of the copper sheath and has even caused damage to the interior of the cable. A hammer should never be used for straightening Pyrotenax.

It is a good plan after cutting lengths to seal each end with compound or bitumen thus preventing ingress of moisture until permanent connections to apparatus are made.

When installing cables in dusty or damp positions particularly in acid-laden atmospheres the cables should be spaced from the surface of the wall by thin spacers so that a ledge is not formed where dust and damp can accumulate.

Connection to motor terminal boxes should not be made as in Fig. 1, but the method shown in Fig. 2 used. The latter is a much more

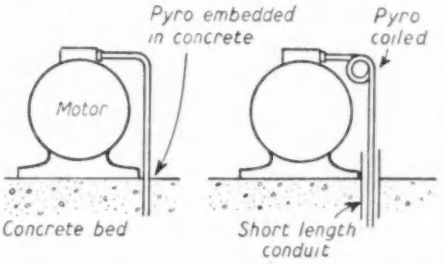



*Fig. 1 (left) shows the wrong way, and Fig. 2 (right) the correct method of connecting up motors when Pyrotenax cable is used*

flexible arrangement and the full coil gives a spring effect useful where there is excessive vibration of the motor and also when a motor removal is necessary. The diameter of the coil must not, of course, be too small.

Again, copper tails for connections (after coming out of the seal) should be given a generous coil, properly formed eyes made, or lugs sweated on and laid in position with the minimum of working in order to prevent breakage due to hardening of the copper cores.—*S. M.*

### *One Phase, Four Wire*

A FEW days ago I received an urgent call to a bakery where the 3-phase s.c. motor of a mixing machine was reported to "hum but not turn" whenever an attempt was made to start it.

Visualising a fuse blown by too-rapid use of the star-delta starter, with consequent "single phasing," I was still collecting testing gear and tools when a message from a second bakery a quarter of a mile from the first reported that *their* motor was behaving in a similar manner.

This immediately suggested that one phase of

the local supply (3-phase, 4-wire, overhead) was dead but on arrival at the first bakery the "Testoscope" showed all three phases to be alive, and a voltmeter test from each phase to neutral proved this to be correct.

By this time a farmer whose premises were half a mile away had arrived at the works office to say that one of his 3-phase motors was creeping round noisily, and another refused to start! Tests failed to reveal a fault in any of the motors or starters, so I turned my attention once more to the incoming supply.

No voltmeter suitable for testing between phases was available, but two lamps in series showed that although all phase terminals were alive, there was no difference of potential between "Red" and "White," so I set out to inspect the overhead main back to the sub-station.

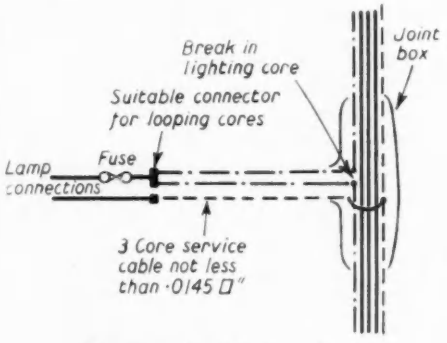
I had not walked far before I saw that two of the conductors were resting together in a forked branch of a willow tree which had grown up between them.

The resulting short circuit had blown one phase fuse at the sub-station, but the other was intact, and the line which should have been dead was being fed through the short circuit.

In this way all domestic consumers were receiving a supply, and only the behaviour of the 3-phase motors brought the fault to light. —*C. Herridge.*

### *Lighting Cable Cores*

REFERRING to the previous correspondence of July 12 and August 23, I think it is generally agreed that these faults can be very aggravating, particularly if it is necessary for the supply to be maintained on the main cores of the cable, but the matter can be very much simplified if the lighting core is looped into each lamp (see sketch). This is slightly more expensive, as it involves three-core service cable instead of two-core to the lamp and the lighting core in the cable has to be severed in each joint box.



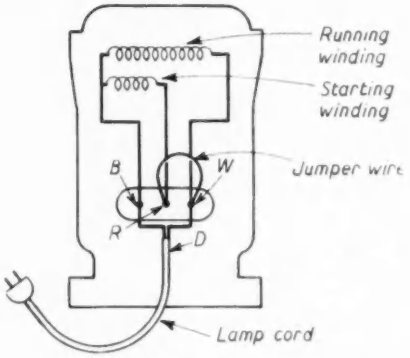

*Test connections for street lamp*

The advantages on long runs of street lamps are obvious, since the lighting core can now be sectionalised, and if there is a feed at both ends of the cable practically all the lamps can be restored in a very short time. In addition, the final faulty length is usually so short that an auxiliary sound conductor can be run above ground and the normal Murray Loop test used between this and the faulty lighting core.

With existing installations using twin-service cables, an approximation to the above can be obtained at a reasonable cost by changing lamp services from two-core to three-core at suitable intervals on the route.—*C. S. B. (York)*

### *Refrigerator Motors*

A USEFUL suggestion for testing hermetic unit motors on refrigerators using 115-volt motors through a transformer is to use an ordinary lamp cord plugged in to the transformer, and a jumper wire that can be easily detached.




*Schematic of motor test arrangement*

If the motor does not start when connected as seen, it is either defective or overloaded. If it does start, then disconnect one end of the jumper wire, which disconnects the starting winding; if the motor stops when this wire is disconnected, it is defective.

If motor continues to run when jumper wire is disconnected, then there is nothing wrong with the compressor or the sealed hermetic unit, and the trouble lies elsewhere.—*B. Q.*

*Contributions to this page dealing with specific items of interest to electrical engineers and maintenance men are welcome, and, if accepted, will be paid for at our standard rates. Contributions should be written on one side of the paper only and may be accompanied by sketches, which will be re-drawn for publication.*

# WELDING IN AMERICA

## Report of the Anglo-American Council on Productivity

THE report of the British Specialist Team on Welding which recently investigated the progress of welding technique in U.S.A. has recently been published and is available from the Anglo-American Council on Productivity, 21 Tothill Street, London S.W.1, price 3s. 6d. (post free). The Team's terms of reference were remarkably wide and covered all types of production, ferrous and non-ferrous, both in the light and heavy engineering field. It was, in consequence, found impossible in the short time available to cover fully all industries mentioned, but the only really large industry completely omitted was the manufacturing of aeroplanes and aeroplane engines. Even so, the Report is remarkably comprehensive and in the brief abstract which follows, we have confined ourselves to those sections dealing with shop processes and electric arc welding, omitting most of the information given on management-labour relationships and conditions of work.

### General Aspects of the Visit

Care had been taken on the part of the organisers of the visits to ensure that the team was shown a representative cross-section of the industrial work of the country. Factories, therefore, varied from those as good as or better (from the point of view of cleanliness, lighting and efficiency) than the best in Britain, to those which were so dirty and overcrowded that the Team felt that British workmen might not take kindly to working in such conditions. Despite the risk of adverse criticism, however, some 20 to 30 American companies made their works available to the Team, invited questions, and placed, so far as one could judge, virtually no restriction of speech on their executives. It was noticed, however, that at meetings with the executives, the British Team showed more curiosity than its hosts. This was attributed to the fact that the Team had developed a "detective" outlook, which was missing in the case of the company officials.

### Handling

All workers on the shop floor make the maximum use of all aids to handling, lifting and positioning with which the management provides them, invariably operating the different appliances themselves.

Sections are usually ordered in the longest possible standards that can be stored, up to about 70 ft. In this respect, it should be noted that mills can roll sections up to 90 ft long, and the American railway system can handle such loads. Further, the range of sections available in America is very much larger than in England, both in sizes and in types, that is, broad flange beam and normal standard mill beam.

The number of overhead cranes is somewhat low compared with practice in this country, but any deficiency is made up by the liberal use of subsidiary lifting devices such as wall jibs, pillar jibs and mobile cranes. In nearly all cases, this equipment is electrically operated. The use of this equipment ensures the minimum of waiting time by labour, because such devices are worked by the machine operator, plater or assembler direct from the shop floor.

Considerably more use is made in the majority of U.S. welding shops of manipulators, particularly where flow-line production has been installed. It would appear that the management is prepared to go to almost any lengths to arrange that all welds can be made in the "down-hand" position, for one or more of the following reasons:

(1) To make possible the use of large-gauge electrodes and high currents, thus obtaining higher deposition rate.

(2) To relieve fatigue, thereby maintaining maximum production and quality.

(3) To make welding as easy as practicable and so make possible the use of less-skilled welders.

Some of these manipulators are of considerable size, a capacity of 20 tons being not unusual. Use is also made of power-driven rollers for the turning of cylindrical vessels.

### Electric Welding

The Report covers in detail the preparation and flame cutting of the components to be welded and continues by describing the welding processes and equipment. The general practice in welding shops is to quote electrode types according to the American Welding Society Classification and not to refer to the particular electrodes by the individual manufacturers' code names. For welding mild steel, the most

common electrodes are the extruded types E.6010, E.6020, E.6012, and E.6013. These are available in sizes not exceeding $\frac{5}{16}$ in. and are used in the ordinary way. For use on steels with high sulphur content, or which have been made from scrap containing traces of nickel and chromium when cracking of fillet welds may be expected, the practice is to use low hydrogen type electrodes. This type is seldom used above $\frac{5}{16}$ in. in size and is also used for sealing runs made in conjunction with automatic submerged arc welding.

A considerable amount of austenitic and stainless steel welding is being carried out, and for this work it is usual to use niobium (columbium) bearing electrodes. Other special electrodes are available for welding heat-resisting steels, Monel metal, bronze and cast iron. The general shop tendency, however, is to use comparatively small size electrodes.

### *Power Supplies*

There are still-many 300/350 amp and 500/600 amp d.c. m.g. sets in use for all classes of mild steel welding, although new plant appears to be entirely of the single operator a.c. type The transformers on the latter are air-cooled and have continuously variable current outputs regulated by moving the cores to vary the reactance. Mainly, they are designed for 500 or 600 amp. working, but some 300 amp units were seen. It was noticed that in all the shops visited, sets were not being operated up to their full capacity. The Americans were surprisingly unfamiliar with the multi-operator welding transformer and the reactors so popular in Britain.

Metal rectifier units have been developed, but owing to their high first cost and lower efficiency, their use is restricted to special electrodes where d.c. is essential. Operators claim smooth welding with less spatter than with m.g. sets. The selenium rectifiers used in this process are claimed to have a "life" of over two years.

It is interesting to note that there is a tendency to get away from the 200 volt 3-phase system and to adopt 400/500 volts for new installations. This lines up with British practice. All the familiar makes of electrode holder are available and each user has his own preference.

Judging from the appearance of the general work, the impression was formed that British welding electrodes are on the average superior to those in use in America. Only in the development and use of low alloy chromium/molybdenum electrodes was anything seen in advance of that available here.

The inert arc process is used for magnesium aluminium and other non-ferrous metals, and in general the equipment is very similar to that used here although helium is frequently used instead of argon. The former gas is, of course, not commercially available in this country.

### *Welding Machines*

The predominating method of automatic welding is the submerged arc process and very few plants were visited in which this process was not being used in one form or another. The processes are available under their trade names Unionmelt and Linconweld and the welding wire is fed into the melted pool of metal continuously.

In the field of resistance welding, standard machines and routine work do not differ much from the design and practice in Britain. There is perhaps a greater tendency to use electronic control and little was seen of the simple pedal-operated spot welder. Three-phase machines for this duty are apparently being used more intensively than in this country.

Special machines of great capacity are sometimes encountered for such jobs as the fabrication of floor grids or the manufacture of large diameter pipes and have ratings varying between 800 and 1,500 kVA.

### *Inspection and Testing*

Generally speaking, inspection is taken more seriously in this country than in the U.S. although in certain works most comprehensive test and check routines are established. Non-destructive test methods used are : radiography with either X-rays or gamma rays; magnetic powder, and ultrasonic methods. The X-ray plants seen in use were almost all of G.E. manufacture and ranged from 150kV to 400kV. The Team was unable to see any 1,000 or 2,000 kV sets in operation. Gamma-rays were only used in a few isolated instances for special purposes such as the examination of welded joins in pipes and in all cases Radium was utilised. No general work had been done on radio-active isotopes for this purpose. It was concluded by the Team that gamma-ray technique was much more advanced in this country than in America.

The magnetic powder technique was not regarded by managements as being particularly successful and ultrasonics are still in the experimental stage.

The report continues with an analysis of the labour/management relationships and finally describes special techniques as used in various industries.

# The Mullard "Telescribe"

## *Commercial Applications Foreseen for an Exhibition Novelty*

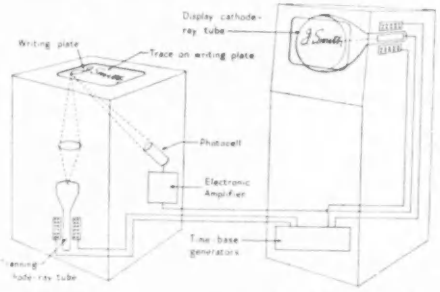
CONSIDERABLE interest was aroused at the National Radio Exhibition by a demonstration of the electronic "Telescribe". This, originally intended merely as an exhibition novelty, is considered to have important commercial possibilities.

The transmitter and receiver units are linked by a single cable and anything written or drawn in grease-pencil on the glass plate of the transmitter appears on the cathode ray tube of the receiver, and remains there until erased.

*Arthur Ferrier, the well-known cartoonist, drawing on the glass plate of the Electronic Telescribe, demonstrated for the first time on the Mullard Stand at the National Radio Exhibition. The drawing appears instantaneously on the screen of a cathode-ray tube located in an adjacent unit*

### *Operation*

The operating principles, shown in the simplified diagram, utilise a combination of television and radio picture transmission techniques. Scanning of the plate is carried out by a raster generated on the screen of a projection type cathode-ray tube, under the control of the normal time base circuits, and the beam from the tube is focused upon the glass plate so that it is continuously scanned by a flying spot of light, which passes through the glass plate except where markings have been made with the pencil. Here it is reflected and falls on to a photo-cell, the output of which is connected to the modulator circuits of the receiving tube whose time base is synchronised with that of the transmitter, so that the beam is modified "light" or "dark" in accordance with the instantaneous value of the reflected spot from the transmitter.




*A simplified diagram showing operating principles*

The system is by no means limited to line drawings—if a photograph were laid face downwards on the glass plate, the spot would record light and dark in the same manner. While the definition of the demonstration model is only 200 lines it would present no difficulty to obtain 1,000 lines.

### *Applications*

The most important application foreseen by Mullard Ltd. is the superimposition of maps on radar display screens, which has obvious value in all radar display systems. It would, for instance, enable any operator controlling an aircraft and plotting its course to superimpose the aircraft's identification and course on the display tubes of all other operators.

A simple instrument of this type could likewise be used in commerce and industry for transferring signatures (i.e. cheques in banking clearance, etc.) and printed matter very rapidly from one point to another for verification in commerce, industry, and, for that matter, criminal investigation.

# overseas news

### Country Districts

Replying to representations made for greater extension of electricity to country areas in Victoria, the Minister for Electrical Undertakings, Mr. K. Dodgshun, gave an assurance that all concerned were alive to the necessity to continue such work. And, in spite of an inadequate supply of constructional materials, 16,521 new consumers were connected in country districts the last financial year, over 30% more than in 1949-50—1,831 farms were newly connected, an increase of approximately 40%. In the four years ended June 30, 1951, 50,099 new consumers were connected in country districts compared with 22,666 in the four years prior to the war —for farms the figures are 5,731 and 2,960 respectively. To further facilitate the construction of rural extensions, the State Electricity Commission of Victoria is using the services of private contractors in areas where this can be arranged.

### Rural Subsidy Inadequate

At a conference in Sydney during last month, representatives of local councils, and Development Committees approved a resolution urging the Government to increase the maximum subsidy for rural electrification from £250 to £400 per consumer. It was pointed out that the present subsidy figure was fixed eight years ago, since when the cost of rural electrification had risen so steeply that £250 was frequently inadequate.

### Price of a Station

The State Electricity Commission of Victoria is paying the Railway Commissioners the sum of £1,728,738 14s. 5d. for the Newport 'A' power station, control of which was transferred to the Commission last January. This was disclosed by Mr. Dodgshun in the Legislative Assembly a few days ago, when introducing a Bill to enable settlement of the debt to be effected by the transfer of loan liability.

### O.H. Line Contract

Work is shortly to start on the erection of 928 miles of h.t. transmission lines for the Queensland State Regional Electricity Boards, the contract for which, valued at £1,369,489, was placed with British Insulated Callenders Construction Co. Ltd., as we briefly reported on August 23. The work, which is expected to take three years, will include main transmission lines from Rockhampton to Gladstone, Childers to Gayndah, Biloela to Theodore, Gladstone to Monto, Stuart to Giru, and Mareeba to Mt. Molloy. Substantial distribution work also would be involved. The new lines will enable small generating plants to be closed, and rural consumers throughout the various regions to be supplied from the new central generating stations.

### Quebec Scheme

The Quebec Government has authorised a diversion of the Megiscane River in northwestern Quebec as part of a 35,000 h.p. hydro-electric development. The project, which has been sanctioned by order-in-council, will raise to a total of 560,000 h.p. the extent of hydro development of the Megiscane area since 1945. One Megiscane area project added 195,000 h.p. to the development at Shawinigan Falls. Another was connected with the development of 330,000 h.p. on the St. Maurice River at La Trenche. But no other details have yet been given of the latest scheme.

### Beauharnois Development

Premier Duplessis of Quebec, officially inaugurated, a few days ago, the Quebec Hydro-Electric Commission's No. 2 plant at Beauharnois, on the St. Lawrence River. This is to house twelve 55,000 h.p. units, of which three were put into operation last month. Plant No. 1 has fourteen 53,000 h.p. sets and two 8,000 h.p. auxiliary machines. Plans are also well advanced on the construction of a third plant which will probably have 14 main units of 55,000 h.p. each.

### Manitoba-Ontario Link

The possibility of Manitoba sharing in new power projects just beyond her borders was referred to by Premier D. L. Campbell last month. He said technical committees from both provinces had been studying the possibility of a new 150,000-h.p. development at Boundary Falls, Ontario, just three miles east of the Manitoba boundary on the Winnipeg river. He conferred with the premier of Ontario, Mr. L. M. Frost, who had agreed to allow Manitoba to participate in such north-western Ontario developments.

### Underground Lines

A decision on the financing of an underground railway system for Milan, is expected to be made known next month by the City Council. Offers of financing have been made by two private groups, Cost of the scheme has been put at between 25,000 and 30,000 million lire.

Meanwhile it is announced that the underground railway line for Rome should be completed by the end of 1952. This project is being financed by the Italian Treasury.

### Railway Electrification

Last Friday, August 31, saw the official inauguration of the new electrified section of the French National Railways, Aix-les-Bains-Annecy-La Roche. The ceremony was performed by M. André Pinay, the Minister for Public Works. This section operates at 20 kV 50 c/s single-phase, and the locomotives have been built by Oerlikon to the design of the Director-General of the French National Railways.

It was also announced that an International Congress on Electric Traction is to be held at Annecy from October 12 to 16. Nearly 200 engineers from France, Italy, Britain and the Scandinavian countries are expected to be present, and prototypes of the 20 kV locomotives will be available for their inspection and by the public.

### Austria's Potential

Today, September 6, sees the opening at Zell am See, Austria, of the third meeting of the regional Austro-Italo-German group of the Union for the Co-ordination of Production and Distribution of Electrical Energy—U.C.P.T.E. The main question for discussion is that of closer co-operation between the three countries to relieve the power shortage. The chief point for consideration will be the building of new power-exporting hydro-electric stations in the Austrian Alps—on the Upper Inn in eastern Tyrol and in the Oetztal. As Austria is not in a position to finance such large-scale projects, capital would be supplied mainly by Italy and Germany. The construction of new hydro-electric stations and the new thermal station at St. Andrae, Carinthia, will provide Austria with a further 520 million kWh of electricity over the remainder of this year. However, the progress of Austrian industrialisation and electrification has resulted in an increase in electricity consumption at the rate of 16% per year, while output is increasing at the rate of only 10% per year.

### Norwegian Project

An underground hydro-electric power station at Aurdal, Central Norway, is undergoing final tests before adding 50,000 kW to Norway's power supply. The turbine hall is over 100 yds long, 20 yds high and 17 yds wide.

### New Plant

Umtala's electricity problems should be solved early next year when the Council's new £85,000 steam plant is completed. The foundation stone for the plant was laid recently by Mr. E. Spilkin, former chairman of the Electricity Committee, and when production starts in about February the 1,500 units which will be generated daily are expected to be adequate for the city's immediate needs. During July, a major breakdown occurred when one of the diesel engines collapsed and a special part had to be flown out from England. At present Umtata is suffering from a further electricity breakdown caused by the drought which has made the water in the river too low for the hydro-electric plant to function adequately.

### Gold Coast Project

A final report to the Gold Coast Government on the potentialities of the Volta River scheme for the development of hydro-electric power and production of aluminium, is expected to be released very shortly. It has been prepared by Sir William Halcrow and Partners, consulting engineers to the Government. An earlier report stated that a proposed dam 5,000 ft long by 450 ft high on the River Volta at Jenna, would provide 750 MW. Bauxite has only been exported from the Gold Coast of recent years. The resources are estimated to exceed 200 million tons. Earlier this year, Mr. R. W. Cooper, chairman of the British Aluminium Co., Ltd., referred to a technical mission sent out by B.A. and Aluminium, Ltd., which estimated that 1,150,000 tons of bauxite could be processed annually into 210,000 tons of aluminium, for which 500 MW would be needed for the smelter plant. This mission considered that the scheme was economically and technically possible.

### Wiring in Advance

An indication that the Auckland Electric-Power Board, N.Z., would permit wiring for new equipment to be done in advance of the increased supply expected when Maraetai is ready was given at a meeting of the Board last month. A recommendation to issue a statement of policy on those lines was adopted, but the chairman, Mr. J. A. Steele, said the subject would have to be treated carefully. There were possibilities of plugs being put in and equipment purchased only to stand unused for 12 months. This action follows a request from the Auckland Electrical Contractors' Association.

### Approval Plan

When the question of margin of safety in some New Zealand made electrical goods and fittings was raised recently, Mr. B. Colbaker, supply engineer with the Auckland Electric Power Board, said a lot of electrical equipment in use might be safe when bought, but if used a lot would not necessarily remain safe. He added that the Board were not happy about it, but provided such equipment had been approved as not conflicting with the wiring regulations, there was little the supply authorities could do. The solution the Supply Authorities' Association was pressing for was for a seal or stamp of authority so that the board could approve an article as fit for general use. The matter was in the hands of the Government and a lead from the State Hydro-Electric Department was awaited, he added.

### Underground Railway

In Brazil, plans are being considered for the construction of an underground railway to serve the city of Rio de Janiero. Technical experts have already recommended that such a system could be built in three sections with a total length of 16 miles. Cost of the project is estimated at £53 million.

# *PERSONALITIES*

## IN THE INDUSTRY

The new assistant engineer-in-chief of the G.P.O., with effect from October 1, is **Col. J. Reading,** M.B.E., B.SC.(ENG.), M.I.E.E., at present G.P.O. staff engineer, as we briefly noted last week. He succeeds to the position vacated by **Dr. W. G. Radley,** who becomes engineer-in-chief on the same date, as we have already recorded. Col. Reading, too, has spent all his career in the Post Office, apart from two spells with the Forces. Graduating at Northampton Engineering College, after a period with the Radio Research Board he entered the Equipment Branch of the Engineering Department in 1925. He was promoted to executive engineer in 1934 and assistant staff engineer in 1937. He has been particularly concerned with the production of standard specifications for automatic exchanges, and has represented the G.P.O. and the B.S.I. at many international conferences. Between the wars, Col. Reading held a commission in the supplementary reserve, Royal Signals, and went to France on the outbreak of war. Later, he served in the Middle East and Italy, and eventually became chief signals officer, War Office Signals. Returning to the Post Office in 1946, he was appointed staff engineer in charge of the equipment branch, and has since been concerned with post-war reconstruction and development, in which connection he has made many friends in contacts with manufacturers.

*Col. J. Reading*

Later this month, **Mr. E. E. Cooper,** A.M.I.E.E., is taking up a position, in this country, with the Anglo-Iranian Oil Co., Ltd., after 25 years service in the supply industry. For the past two years he has been senior assistant engineer (construction), with the South Eastern sub-area of the London Electricity Board. His early training was obtained with the Walsall Corporation Electricity Department, which he left in 1936 to join the King's Lynn undertaking as assistant mains engineer, later becoming mains engineer. From 1946 to 1949 he was distribution engineer at Reigate, first to the Corporation, and later the South Eastern Electricity Board, before joining the London Board in the post which he is shortly vacating.

The Wardle Engineering Co., Ltd., has appointed **Mr. G. Johnson,** 57 Keswick Road, Sheldon, Birmingham 26 (Tel.: Sheldon 2245), to represent them as agent for Birmingham and the Midlands.

Assistant engineer at Carville power station, North-Eastern Division, B.E.A., **Mr. J. H. Dawson** has won an award from the American Economic Co-operation Administration which will entitle him to a year's study of production, technical and management problems at the Rensselaer Polytechnic Institute, New York. His award was one of 35 offered by America. Mr. Dawson served an apprenticeship with the Harrogate Corporation Electricity Department, and obtained an honours degree in electrical engineering at Leeds University.

**Mr. I. H. Mair,** assistant engineer with Nottingham Corporation transport system, has been appointed rolling-stock engineer with the Newcastle-upon-Tyne transport system.

**Mr. P. Hay,** who has been sales engineer and previously senior estimator, at the Manchester office of Crompton Parkinson (Plant Division), has relinquished that appointment to become a sales engineer at the Manchester sales office of Lancashire Dynamo and Crypto (Mfg.), Ltd. He served an apprenticeship with William Auld and Sons, of Ayr, and was previously with L.D.C., being employed as an estimator at the company's Trafford Park Works for three years prior to 1948.

*Mr. P. Hay*

**Mr. C. L. G. Fairfield,** M.A., A.M.I.E.E., A.M.I.Mech.E., Barrister-at-Law, has been appointed manager of the Valve Division of Mullard, Ltd. It will be recalled that he joined the Mullard organisation in 1947, as assistant to the directors in a technical capacity. He was previously with Balfour, Beatty and Co., Ltd., the Central Electricity Board and Metropolitan-Vickers Electrical Co., Ltd. While with the C.E.B. from 1937 to 1945, he was engaged in the testing and maintenance of all types of equipment, including switchgear, transformers and protective devices, in addition to two years in the Board's Commercial Department at Head Office.

*Mr. C. L. G. Fairfield*

*Commander Kent, right, receives the presentation from Mr. W. G. Ardley*

Nearly 300 retired and present employees with more than 25 years' service with George Kent, Ltd., recently attended a celebration dinner in London, when volumes containing an illuminated address and the signatures of all long-service employees were presented to **Commander P. W. Kent,** chairman of the firm, and **Mr. W. G. Ardley,** joint managing director. Mr. Ardley, with 58 years' service, is the longest-serving present member of the concern and took a great part in the company's earliest developments in large-scale water-flow measurement. Commander Kent was appointed to the board in 1919 and has been chairman since 1947. The total number of the company's serving employees with over 25 years' service is 279, and of retired members 42, with a combined total of years of service 10,853.

At present assistant district engineer at Chester-le-Street in the Wear sub-area of the North-Eastern Electricity Board, **Mr. N. T. Palmer,** A.M.I.E.E., has been nominated district engineer at South Shields, in succession to Mr. G. H. Dale, who recently retired. Mr. Palmer was educated at Nottingham University College, and after three years with the B.T.H. Co., joined the former North-Eastern Electric Supply Co., Ltd., in 1938.

**Sir Arthur P. M. Fleming,** who recently, while retaining his seat on the Board of the Metropolitan-Vickers Electrical Co., relinquished his executive duties as director of research and education in that company, as we noted last week, is now undertaking wider responsibilities, having been appointed director of research and education of Associated Electrical Industries, Ltd. Sir Arthur has for some years been chairman of the A.E.I. Research Committee which co-ordinates the research activities of the manufacturing companies in the A.E.I. group.

To enable **Dr. F. Brailsford,** PH.D., M.I.E.E., Professor of electrical engineering at University College, London, to continue his research work on magnetic materials, a grant of £2,040 has been made from the Central Research Fund for the purchase of the necessary apparatus. Dr. Brailsford joined the University at the beginning of this year, it will be recalled, after over 20 years in the Research Dept. of Metropolitan-Vickers Electrical Co., during the latter part of which he made important contributions to the study of magnetic materials.

Returning to Johannesburg, later this month, is **Mr. A. H. Mellor,** the city lighting engineer, who has been in this country for some weeks. In the course of his stay he has seen many of the Festival and autumn illuminations, and plans to visit Blackpool, where the lights are to be switched on today, September 6.

In view of Mr. H. L. Kirke's prolonged absence on sick leave, it has been decided to appoint **Mr. F. C. McLean** as acting assistant chief engineer to the British Broadcasting Corporation with effect from September 1. He will take over Mr. Kirke's work of co-ordination and direction of the technical work of Research Dept., Planning and Installation Dept., Designs Dept. and Equipment Dept.

Just nominated technical executive assistant to Sir John Hacking, M.I.E.E., deputy chairman (operations) of the British Electricity Authority is **Mr. P. W. Cash,** B.SC.(ENG.), A.C.G.I., M.I.E.E., who thus succeeds Mr. G. R. Peterson, who recently became generation engineer in the chief engineer's dept. Mr. Cash received general education at Malvern College and technical education at the City and Guilds (Engineering) College, and has since gained extensive experience in the electricity supply industry, first with the Metropolitan E. S. Co., Ltd., then for four years in Malaya with the Perak River Hydro-Electric Power Co., and, since 1932, with the C.E.B. and the B.E.A. With the C.E.B. he served in the S.W. England and S. Wales area, and as chief assistant operation engineer at head office prior to becoming operation engineer to the Central England area in September, 1944. With the establishment of the B.E.A., Mr. Cash returned to London early in 1949, as engineer responsible to the system operation engineer, being concerned with the preparation of generating plant extension programmes and the scheme for the future 275 kV grid. He later became special engineering assistant to Mr. V. A. Pask, M.I.E.E., M.I.Mech.E., the chief engineer.

*Mr. P. W. Cash*

## OBITUARY

**Mr. L. Champney,** B.SC., M.I.E.E., of the Admiralty Research Laboratory, Teddington, Middx., died on August 28, aged 52.

**Mr. G. S. McKay,** assistant manager of Karachi branch of Standard Telephones and Cables Ltd., died on September 2, in a car crash.

# Quicker Canadian Approval

ELECTRICAL exports to Canada will take on a new importance with the turn in the dollar balance situation, and the present time seems appropriate for a review of a combined Canadian-British venture in standardisation and testing. As most exporters to the Dominion are aware, electrical apparatus intended for connection to public supply mains in Canada has to be approved by the Canadian Standards Association. Up to 1950, this involved the sending of samples to Toronto for test and inspection, but since that date, facilities have been available in Great Britain to cover the majority of appliances, and up to the present time some 270 applications for approval have been handled by the British Standards Institution, acting as agents in this country for the C.S.A.

Some of the factors making it necessary for British-made equipment to be checked are not always recognised. An instance is the different voltages encountered in Eastern Canada, where industrial supplies are 3-phase 550/600V, with full line voltage to earth.

Approvals procedure in this country includes identification of the appliance by description, sometimes accompanied by illustrations of important parts. Full compliance with the Canadian Electrical Code is then assured by means of tests carried out either at manufacturers' works or in independent test houses. Important tests are always observed by a B.S.I. engineer specially conversant with C.S.A. practice. A report on the equipment is then compiled, and this is sent to the C.S.A. laboratories for approval.

At present, some 80 individual Canadian approvals specifications deal with all types of equipment. Where apparatus cannot be covered by an individual specification it is necessary to apply the relevant parts of other specifications the knowledge of which to apply can only come with experience. This experience is being collected in the U.K., and as time goes on it will, obviously, be possible to refer to Canada less and less frequently.

The list of equipment that has already received approval indicates the wide range of the scheme: the list includes cables, domestic accessories and appliances, industrial switch and control gear, machine tools, motors, welding equipment, food preparing machines, office machinery and fans. A classified list of approved U.K. equipment is available, together with other information about the scheme, from the B.S.I./C.S.A. Approvals Division, 24 Gillingham Street, London S.W.1.

# NEW LITERATURE

### *Dielectric Breakdown of Solids*

*by S. Whitehead*, M.A., PH.D., M.I.E.E.

ALL electrical engineers must have an interest in the dielectric strength of materials, in whatever branch of the profession they practise, but many are frightened from a deeper inquiry into the physical basis of this characteristic by the amount of involved mathematical reasoning usually found in the relevant specialist papers. It is a pleasure to be able to record that such feelings are unlikely to be around when Dr. Whitehead's present volume is taken up. An attractive style of writing does much to smooth the path of the reader with a general engineering interest, while at the same time finding room for the inclusion of detail required by the specialist.

Intrinsic breakdown is the topic treated first, and at greatest length, in this book. A review of early theories leads to present-day ideas, and to notes on the effect of temperature, thickness and time. Subsequent chapters deal with thermal breakdown, with breakdown caused by discharges, and with electrochemical deterioration. A final chapter relates the theory of the earlier part of the book to electrical engineering practice. Though intended principally for physicists, this volume can be confidently recommended to electrical engineers. Published by the Oxford University Press, 271 pages, 8½ in. by 5½ in. 25s.

### *Travelling Waves on Transmission Systems*

*by L. V. Bewley*

TRANSMISSION systems here are power lines and networks, and the aim of this book is to present succinctly the modern theories on the behaviour of lightning and switching surges in such systems. From the nature of the subject, there are mathematical equations to be found on most pages, but the author successfully avoids any temptation to depart into a whirl of ideal cases, and constantly brings the reader and himself back to earth by examples taken from engineering practice, often supported by reproductions of oscillograms. The work is in two parts, the first dealing with the origin, characteristics, and behaviour of travelling waves. After the line equations have been developed, attenuation, distortion and reflection receive attention, and then multiconductor systems, multivelocity waves, and the theory of ground wires and counterpoises. Chapters on such practical matters as lightning strokes, arcing grounds, switching surges and surge modifiers complete this first part of the book. The second is considerably shorter, and covers high frequency oscillations and terminal transients of transformers. It includes a note on the suppression of internal oscillations by electrostatic shielding. Published by Chapman and Hall, 543 pages, 9 in. by 6 in. Second edition, price 96s.

# Continuous Oxygen Recording

## *New Equipment Uses Paramagnetic Phenomenon*

A NEW paramagnetic continuous oxygen recorder has been developed by George Kent Ltd., of London and Luton. Robust, reasonably priced and accurate, the new instrument is in complete contrast to the expensive and complicated equipment in common use until recently.

### *Design Principles*

The design of the primary element of the recorder (the analyser) is based on the so-called "magnetic wind" principle and owes its efficacy to the fact that, of the common gases, only oxygen and nitric oxide are attracted by a magnetic field, oxygen more than twice as strongly as nitric oxide.

To obtain a continuous sample of the gas being analysed, a primary refractory filter is inserted at a suitable point in one of the gas passes. The sample is induced through the filter by a water-operated aspirator fitted to the oxygen analyser. The sample gases are carried through pipes to a measuring cell—an annulus with a horizontal glass by-pass tube. This by-pass tube carries on the outside two identical, adjacent platinum windings which are joined in a Wheatstone Bridge circuit and become heated when a voltage is applied across the bridge. One of the windings only is traversed by an intense magnetic field from a large permanent magnet. When the gas sample enters the measuring cell, oxygen is attracted into the by-pass by the magnetic field. As it becomes heated by the winding it loses magnetic susceptibility, is displaced by cool gas, and passes along the by-pass into the annulus. This continuous gas flow, or "magnetic wind," causes differential cooling, and thus differing electrical resistance, in the two windings on the by-pass, unbalancing the bridge. The resulting out-of-balance e.m.f. is measured by a standard Kent "Multelec" potentiometer/recorder and is proportional to the oxygen in the sample.

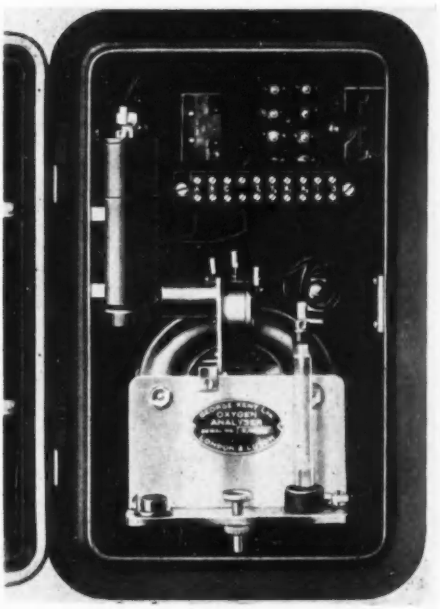
Mountad in a small cast aluminium case, the primary unit is neat and compact, easily installed end requires practically no maintenance. All parts of the unit in contact with the gas sample are corrosion-resistant.

### *Performance*

A generous sample of 15 litres per hour is passed through the analyser, which begins to register a change of oxygen content within 5 seconds of its occurrence and gives a 95% response in 45 seconds. An analyser of this type is sensitive to ambient temperature conditions, which are automatically compensated for by means of a resistance thermometer in a circuit capable of dealing with the range 0°-50° C. The temperature of the gas sample must not exceed 75° C at the analyser inlet.

The whole instrument is capable of dealing with most of the gas mixtures met with in industrial practice, but to avoid congestion of orders in the early stages applications are initially being limited to the following ranges: Oxygen in nitrogen, 0-5%, 0-10%, 0-15%; oxygen in hydrogen, 0-2%; oxygen in coal-gas, 0-2%.

The installation is entirely mains-operated, and a constant-voltage transformer is supplied with the equipment to smooth out supply-voltage fluctuations. The primary element (the analyser) can be located at any distance up to 400 yards from the recorder.



*The Kent continuous $O_2$ Recorder*

D

# BRITISH STANDARDS

**Power-Driven Derrick Cranes.** *B.S. 327, Pt. 1: 1951. Price 6s.* This is the fourth revision of B.S. 327 standard, which was originally published in 1928. It indicates the minimum requirements for power-driven derrick cranes of the normal type, and is intended to secure the general observance of such fundamental principles as appear desirable to secure reliability and safety without hampering the freedom of the crane maker in his selection of the most appropriate design for the purpose in view. The standard deals with Scotch derrick, Guy derrick and Tower derrick types of cranes, and lays down requirements relating to the crane as a whole, including electrical equipment and provisions for testing. The clauses in regard to electrical wiring and cables have been brought into accord with the 12th Edition of the Regulations for the electrical equipment of buildings recently published by the Institution of Electrical Engineers

**Power-Driven Mobile Cranes.** *B.S. 1757: 1951.* Price 6s. This is a new British Standard which has been prepared to deal with road wheel mounted and tracked power-driven mobile cranes, and it covers several different types. These types include both the full slewing, part slewing and non-slewing types which may be either fully mobile on their own wheels or tracks, or fully mobile and mounted on lorries. It also covers semi-mobile types and portable cranes. This standard follows lines similar to the other crane standards by indicating minimum requirements with the intention of securing the general observance of such fundamental principles as are desirable to ensure reliability and safety without hampering the freedom of the crane makers in their selection of the most appropriate design. At the same time guidance is provided for the user regarding the types of crane covered by the standard.

**Railway Signalling Symbols. Part I, Schematic Symbols.** *B.S.* 376 : 1951. *Price* 5*s*. In preparing the schematic symbols for this revised standard, an endeavour has been made to provide for apparatus in general use, and they have been designed so that they may be combined with each other where one does not adequately represent the complete device. Each symbol is identified by a reference number, and an alphabetical index is included.

**Alternating-Current Relays for Railway Signalling.** *B.S.1745*: 1951. *Price* 2*s*.—It has been found desirable to revise the series of British Standards for relays for railway signalling and the opportunity has been taken to combine in this standard the provisions of B.S.520 "Alternating-current track relays" and B.S.557 "Alternating-current line relays" since many of the provisions of these two standards were similar. The new standard applies to alternating-current line and track relays of the induction type intended for use in railway signalling circuits not exceeding 250 V, and is applicable to relays with or without a local element.

**B.A. Screws, Bolts, Nuts and Plain Washers.** *B.S.* 57: 1951. *Price* 3*s*. This publication confirms as a regular British standard the war emergency standard published in 1944, subject to certain modifications which more recent experience has shown to be desirable. General dimensions for all the common types of B.A. screws, bolts and nuts in sizes 0 B.A. to 16 B.A. are included, and the ranges of nominal sizes given in the tables are classified as "preferred," "second choice" and "not normally stocked." Tables relating to each type of screw and showing the lengths in which each size is normally stocked, and other lengths which may be regarded as standard, although they are not normally stocked, are also included. General requirements in respect of material, screw threads and finish are given, and dimensions are specified for two types of washers.

**Glossary of Piezo-electric Terms.** *Supplement No. 5 to B.S. 204. Price* 1*s*. This supplement to B.S. 204 (glossary of terms used in telecommunication) defines a short series of terms used by engineers and others in connection with the preparation of piezo-electric crystal units, and they are engineering rather than crystallographic terms.

**Thermodynamic Properties of Refrigerants.** *B.S.* 1725, 1951. *Price* 10*s*. 6*d*. Tables of the thermodynamic properties of ammonia, sulphur dioxide, carbon dioxide, methyl chloride and dichlorodifluoromethane are the main content of this document. These tables are reproduced by permission of various authorities and acknowledgement to them is given in the introduction to the standard. An appendix has also been included giving a list of references from which details of thermodynamic properties of refrigerants, not covered by this British Standard, may be obtained.

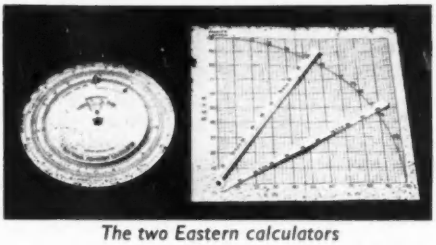
**Woven Asbestos Binding Tape for Electrical Purposes.** *B.S.* 1720: 1951. *Price* 2*s*. Applying to plain, unimpregnated woven asbestos tape, having selvedges, suitable for binding purposes for electrical apparatus, this standard does not include tapes having an all-cotton weft or warp, or the grade of tape for electrical insulating purposes, for which another British standard is in course of preparation. It recommends the identification of such binding tape by green-coloured warp threads woven into the centre of the tape or selvedges. It includes details of finish, length, thickness, width, and the number of threads, and the appendices deal with methods of conditioning specimens for test, determination of the length of a roll, of thickness, of width, of cotton content, of conducting inclusions and, in addition, methods of test for ageing and tensile strength.

Copies of these standards may be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London S.W.1.

# *The* BUYER'S *Column*

## New Calculators

TWO new calculators recently introduced by EASTERN ELECTRIC SERVICE, "C" Dept., Norton Park, Edinburgh 7, should save electrical engineers and technicians much time and labour.



*The two Eastern calculators*

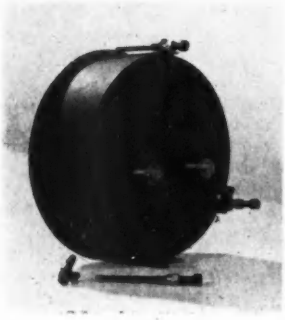
The double-sided circular unit, which should appeal to all maintenance electricians, not only saves time in selecting the correct size of fuse wire for motors, but solves power factor problems on the other side. Load currents and correct fuse sizes can be found with one setting of the h.p. scale while, as an additional convenience, a number of holes drilled round the outer edge give wire sizes without either guesswork or the necessity of carrying a wire gauge. The other side is devoted to power factor problems, giving the relationship between kW, kVA and p.f. at one setting.

The other calculator is for solving problems in power factor and power factor improvement, and takes the form of a handy size version of the familiar kVA quadrant chart, with two movable scales, the whole folding into a space of 6 in. by 3 in.—a handy size for the pocket.

Prices of the calculators are 7s. 6d. for the circular unit and 6s. for the kVA chart.

## New English Electric Instruments

A PATENTED method of flush mounting is one of the outstanding features of a new range of switchboard instruments developed by the ENGLISH ELECTRIC CO. LTD., of Stafford.



*Flush fixing arrangements and front view of new English Electric instruments*

Ammeters and voltmeters, both m.i. and m.c. are available in nominal 4 in. and 6 in. round and square patterns, while single and poly-phase dynamometer wattmeters are available in 6 in. round and square. Our illustrations show the bold, open-scale markings of the new instruments and the method of flush mounting in which the instrument is inserted in the panel from the front, being held in position by flat springs on the case. Clamp plates and fixing screws are then added.

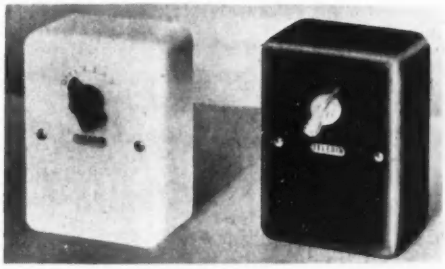
## Anti-Vibration

INFORMATION recently received from HOWARD CLAYTON-WRIGHT, LTD., of Wellesbourne, Warwickshire, describes the "Clayflex" vibro-damper for anti-vibration mounting of machines. These consist of an inner stud mounted inside an outer support with mechanically bonded rubber insulation supported in shear. Made in 12 standard sizes, from $\frac{3}{16}$ in. to 1 in. stud, with ratings varying from 10 to 2,000 lb loading per unit. Outer diameter of fixing flange vary from $2\frac{1}{2}$ in. with four $\frac{1}{4}$ bolt holes to 8 in. with four $\frac{5}{8}$ bolts. They are simply and easily installed.

*"Clayflex" vibro-damper*

## Control Unit

THE "Teledim" control unit, a new design of tapped choke dimmer, is now being marketed by A. E. SOMMERS AND CO., LTD., of Elektron Works, 96a Sydenham Road, S.E.26. Intended



*The "Teledim" in brown or cream case*

for lamp dimming for hospitals, nurseries and general lighting applications including fan and blower control, the "Teledim" has five tappings in addition to an "off" position and can replace an

ordinary tumbler switch without additional wiring. Rated at 100 W, the dimensions are 3½ in. by 5 in. by 2 in. (excluding the knob) and the list price is 45s. in brown bakelite and 47s. 6d. in cream.

### Mobile D.O.

THERE can be few engineers or draughtsmen who have ever tried to make sketches of reasonable quality away from the drawing office without wishing that they could carry a drawing

*Two views of the Quickdraw drafting board*

board around with them. This is now possible. The "Quickdraw," a portable drafting unit manufactured by the QUICKDRAW COMPANY of 127 Gunnersbury Avenue, London W.3, weighs only 2 lb and takes the form of a folder 14 in. square, one side of which is pocketed for paper and sketches, while the other forms a rigid drawing board with corner pockets, so that only one drawing pin is

necessary to hold the paper absolutely rigid.

Attached to a Perspex parallel motion (replacing a tee-square) is a template of the same material which provides in addition to horizontal and vertical scales (in. and mm), triangles, circles from ⅛ to 1 in., and edges at 45 and 30° (the latter being invaluable for isometric sketching), as well as holes for accurate cross-hatching. Price 63s.

### B.N.E. Space Heating Price Increases

CONTINUED rise in costs has compelled BRITISH NATIONAL ELECTRICS, LTD., to increase the list prices of certain items of space heating equipment. New prices for fires are: Model F43, £5 5s.; Model F101, £1 15s.; Model F102, £2 12s. 6d. The F103 reflector fire has been suspended owing to shortage of materials. Tubular heater prices are also increased, a new schedule being supplied on request.

## TRADE PUBLICATIONS

INFRA RED DRYING.—Infra red equipment for the drying of viscose seals on bottled goods is illustrated and described in a recent leaflet issued by Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17.

ELECTRICAL ENGINEERING.—Latest additions to the range of Metrovick publications include:

12/4a-1, Application of Electro-Hydraulic Thrustors.
32/6-1, Totally-enclosed Fan-cooled Induction Motors—Type R.
43/2-1, A.C. Variable-speed Commutator Motors—Type CH.
85/20-1, Control Push-button for a.c. and d.c. Circuits.
87/5-1, D.C. Contactor Starters with definite time acceleration—Type RMC.
97/9-1, Mining Contactor Units (Room Switches).
296/2-1, Flameproof Switchgear—Type SF1/250.
426/12-1, Hydrogen Coolers for Turbo-type Generators.
435/15-1, Vacuum Pumping Equipment (Oil diffusion pump—Type 03B).
712/1-1, Peat Production in Ireland.
5090/3, Contactor Starters—Type DOC.

These are available from Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17.

PNEUMATIC CONVEYING PLANT.—Publication 6504, superseding 6503, issued by the Sturtevant Engineering Co., Ltd., Southern House, Cannon Street, London E.C.4, is concerned with the range of grain conveying and bin drying plant supplied by the company.

REFRACTORIES.—Details of the new refractory Morgan M.R.I are set out in a recent leaflet, RD 30, by the Morgan Crucible Co. Ltd., Battersea Church Rd., London, S.W.11.

BATTERY CHARGERS.—Matters concerning the new works of the Steel Company of Wales are topical. Crypton Equipment, Ltd., 1 Victoria Street, Westminster S.W.1, have thus reprinted from *Electric Vehicles* an article on a Crypton two-rate charger which services the mammoth electric trucks used there.

WIRING ACCESSORIES.—Terminal blocks, strips, rubber grommets, bushes, moulded bushes and china connectors are listed in publication OH 31/113 issued by Metway Electrical Industries Ltd., King Street, Brighton 1.

OIL RETAINING BEARINGS.—A broadsheet issued by The Morgan Crucible Company, Ltd., Battersea Church Road, London, S.W.11, has "Hints on Design for Morganite Reservoil Oil Retaining Sintered Metal Bearings."

# THE WEEK

## COMMERCE *in news* INDUSTRY

### *Power Failure on Merseyside*

A MAJOR failure in the power distribution and transmission network last Monday night resulted in severe dislocation of traffic, great inconvenience to consumers and several fires over a large area surrounding Liverpool.

At the time of writing, full details of the technical reasons for the breakdown have not been issued, but from information received it appears that a fault on the Carlisle-Kendal-Lancaster grid line resulted in the breakers tripping. The loss of this line at a time of peak loading was sufficient to cause overloading of other grid lines supplying the area, which also tripped. Local power stations were unable to cope with the demand and a complete collapse of the local system followed together with isolation from the Grid.

Towns affected included Liverpool, Blackpool, Heysham, Preston, Southport, Warrington, Wigan, Lancaster, Fleetwood, Morecambe, Thornton Cleveleys, Chester, Birkenhead, St. Helens and Colwyn Bay. Liverpool was the worst sufferer, but in most places supply was restored in 2½ hours (5 p.m. to 7.30 p.m. approx.). During that period, low voltage caused several refrigerator motors to overheat, and fires resulted.

Main line trains were held up due to the stranding of electric trains on crossovers on the Southport and Ormskirk lines, while trams and trolleybuses stranded in the streets disorganised petrol-driven vehicles.

### *Wage Increases at Power Stations*

A WAGE increase of 2d. per hour has been awarded to manual workers in the electricity supply industry, with effect from June 1 last. This amount is slightly more than the B.E.A.'s offer of 5%. Settlement was reached at last Wednesday's meeting of the National Joint Industrial Council, and the hearing of the dispute, fixed for last Thursday, was cancelled. The dispute arose when, to a union claim for a 10% increase, the B.E.A. offered 5%. Subsequently protest action was introduced by many men until by last Thursday over 5,000 employees at 39 power stations were concerned in a ban on overtime. With the announcement of the agreement, the N.J.I.C., with the unanimous support of the Union representatives on the Council, stated that the unofficial protest action taken when the employers refused to grant in full the unions' claim for a 10% wage advance, "had imperilled the chances of a settlement of the claim." But there are reports this week of men continuing the overtime ban.

### *Scheme for Machine Tool Trade*

A SCHEME drawn up by the British Association of Machine Tool Merchants to assist in achieving the requirements of the defence programme was outlined by Mr. S. W. Rawson, director-general of machine tools, M.o.S., at a recent meeting of representatives of the trade. He gave a detailed statement of the needs of defence and emphasised how vital it was that he should have available details of all secondhand machine tools in the short supply categories. The new scheme created the opportunity for his department to consider each secondhand machine in short supply. It also provided for a liaison committee comprising seven representatives of the trade who would advise him, and for technical assistance locally.

### *Technical Direction*

TECHNICAL and scientific manpower problems were discussed by Lord Hankey, chairman of the Technical Personnel Committee, when he gave the fourth of the centenary lectures arranged by the Ministry of Labour and National Service, last week. After reviewing recent advances in the output of graduates in science and engineering, he went on to emphasise the importance of some knowledge of the humanities to such men and women. Although some universities called for a pass in some such subject as part of the qualification for a science degree, the same object could be achieved by emphasising the value of self-education by extensive reading. Lord Hankey went on to refer to the need for a special type of scientific and technological administrator required for some positions, but often hard to find. He suggested that industry would find it worth while setting up a staff college for training in such arts.

### *The First Half-Century*

The situation is growing serious and demands an heroic remedy. In this country we are undergoing the revolution in station practice already effected in America and on the Continent. Small sets and continuous or single-phase generation are going out of fashion. The cry goes forth for two- and three-phase generation of huge capacity. Why should not one of our big firms take the bull by the horns and build a big set on its own initiative to show that the thing can be done at home?—*From our issue of September* 5, 1901.

## *Equipment for Export*

AN ORDER for 31 units of metalclad switchgear has been placed by the State Electricity Commission of Victoria with Metropolitan-Vickers, it was announced by that company last week. This equipment is for service at the Newport "A" power station and is of the single-bus type with a rated short-circuit capacity of 750 MVA. Another notable contract placed recently, was for one of Marconi's new 100 kW medium frequency air-cooled transmitters. This is for the Egyptian Ministry of Communications and will be installed at Abu Zaabal, near Cairo, where it will be housed in the same transmitter hall as the company's 100 kW high frequency transmitter, now being delivered. The latest contract is valued at about £80,000 and follows a number of others received from various parts of the world for similar equipment.

## *Film Award for E.D.A.*

FURTHER honours were gained by E.D.A. at this year's International Venice Film Festival. The film which gained distinction on this occasion was *Magnetism*, which as readers may recall was reviewed together with its companion *What is Electricity?* in our March 1 issue. Besides gaining first prize in the Physics section, it also helped Britain to carry off the prize for the greatest number of scientific and art documentary films. Past distinctions gained by the Association's numerous productions include first prize in the Scientific section with *Electro-Chemistry* as recently as last year, and a diploma with *The Electric Refrigerator*, at the 1948 Festival.

*Crompton Parkinson's new animated counter display available to dealers as part of this season's lamp advertising campaign*

## *No More Explanations*

DEALERS will not have to delve into lengthy explanations to customers of the relative advantages of coiled-coil and "Whitelight" lamps this coming season. Crompton Parkinson Ltd. have successfully dealt with this possibility with their new counter display which features three lamps in holders concealed within cartons. Each lamp is controlled by a working replica of the "cheerful" switch, appearing in all Crompton advertisements, and customers may judge for themselves the difference in light quantity and quality. Another novelty in the company's publicity campaign this winter is a slogan banner with a string of lamp cut-outs spelling the name "Crompton." This is adjustable to any length between 5 ft and 12 ft. Also capable of adjustment to widths of from 3 to 6 ft is the new full-colour window display standing some 3½ ft high. In addition there are showcards, counter cards, window transfers and literature available to dealers—a wide assortment of aids all backed the usual campaign on hoardings and in the Press. Other material for stockists includes a full colour counter card, an "at-a-glance" price list and a circular slogan disc which adheres to glass doors and windows without being stuck.

## *Miners' Supply Still in Abeyance*

ROSSINGTON miners' duel with the B.E.A. and Yorkshire Electricity Board over the supply of electricity to some 1,600 houses in the district continues. It will be recalled that last June the miners threatened to strike because the scheme was held up, but notices were subsequently withdrawn. The Y.E.B. maintain that they cannot connect the houses to mains due to the limited capital at their disposal. The matter has now been placed in the hands of Mr. Tom Williams, M.P. for the Don Valley, but the line of action to be taken now, remains a secret. Meanwhile letters from Lord Citrine and the Board's chairman still say that the Rossington scheme will have to wait.

## *U.K. Representation Abroad*

EMBASSIES and legations in foreign countries and trade commissioners in the Commonwealth are anxious to obtain as comprehensive a record as possible of local agency arrangements of traders in this country. These officials have pointed out that they are constantly being approached by prospective buyers who want to know the names of the local agents of U.K. manufacturers. Others, they say, could also be recommended to approach representatives of suitable manufacturers in this country, if the information was available. It appears, therefore, in the interest of manufacturers to forward such arrangements to commercial offices and trade commissioners. The names of these officers appear regularly in the Board of Trade Journal, but that Ministry's Commercial Relations and Export Department is willing to assist in forwarding relevant details.

*A section of the street lighting installation carried out by Revo in the picturesque town of Ledbury. Admiration of many old buildings is not now confined to daylight, in fact the beauty appears to be enhanced after dark*

### *Lighting at Ledbury*

A NEW lighting scheme at Ledbury carried out by Revo Electric Co., Ltd. has achieved the dual purpose of increasing safety in the town after dark and of accentuating the architectural beauty of many old buildings. The installation comprised 27 fittings mounted on concrete columns and brackets. The lanterns used were the company's "Silverblue" units housing 250 W horizontally burning mercury vapour lamps, a notable feature of which is the dual reflector system. This, together with the patent glass refractor panels, ensures the maximum utilisation of all available light and the elimination of glare. Columns employed were Revo "Phidias" type, with brackets of 6 ft projection, which have been erected on the inside of pavements. Planning of this scheme was done by the Midlands Electricity Board.

### *Indirect Restaurant Lighting*

PREDOMINANT feature of a recent lighting installation carried out in a Singapore restaurant by the local branch of G.E.C. is that most lamps have been set in coves. As can be seen from the accompanying photograph nearly all the light is indirect. The main source of illumination issues from some 280 ft of gold and blue cold cathode tubes set in a cove running round the main portion of the ceiling above the dance floor. On the stage also, light emanates from vertical coves housing 60 ft of gold, blue and red tubing, which incidentally can be controlled to provide a variety of colour effects. Lighting above the tables is again in coves, this time circular in shape with a 4 ft diameter. Other parts of the restaurant have direct lighting from tungsten lamps in 9- and 12-in. fittings with louvres. From the illustration the scheme appears to be most effective, blending admirably with the architect's design of the restaurant.

### *Education in London*

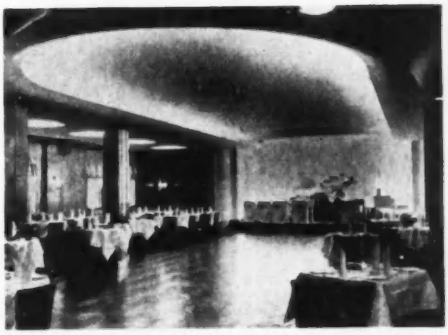
AT this time of the year many junior members of the electrical engineering profession are making arrangements for part-time study during the coming winter, and some of the brochures received in this office may be of help to them. Last week we noted the scheme available in the Manchester district. This week, out of the London colleges, we select the South East London Technical College, where two interesting advanced courses are held. The first of these is a course of 12 lectures and 12 laboratory periods, given by Dr. T. J. Lewis, under the direction of Prof. W. J. John, in High Voltage Engineering (Tuesday evenings). Communication networks theory and practical design networks is the subject of the other 24 lecture course, Dr. W. Saraga being the lecturer, also on Tuesday evenings.

### *The Training of Customers*

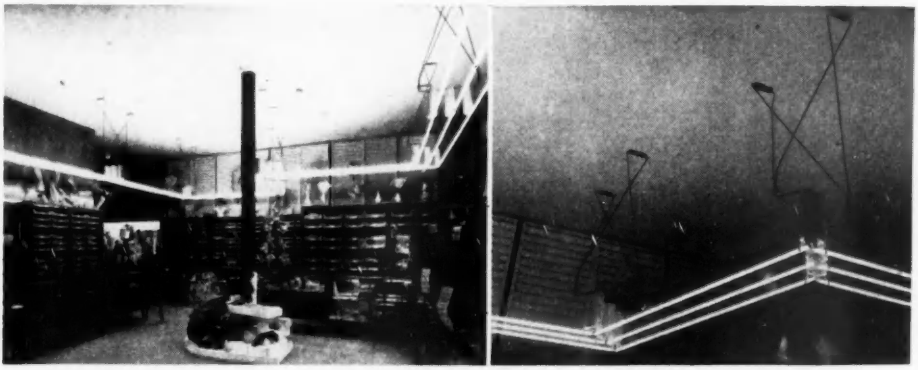
WE learn that George Kent Ltd., of Luton, have begun a series of courses for instrument mechanics and engineers to give a thorough training on the use of their equipment to individuals sent to the works by customers.The courses last for four or five weeks, during which period whole-time instruction is given on the theory, operation and maintenance of Kent's instruments and control apparatus.

### *Twenty-fourth Annual Dinner*

NOVEMBER 23 has been fixed for the 24th annual dinner of the S.E. Division of the Electrical Power Engineers' Association, given to members of the National Executive Council. As on



*A striking example of indirect lighting in a scheme installed by the Singapore branch of G.E.C. at the Capital Ballroom and Restaurant in that city*



*General and close-up views of a novel lighting installation carried out in the lingerie shop of S. Weiss and Co. Bare cold-cathode tubes suspended by rods replace the more usual shades and lanterns*

previous occasions the venue will be at the Connaught Rooms, London, and proceedings will begin at 5.30 p.m. Tickets have been priced at 25s. for members and 27s. 6d. for non-members, and are obtainable from the divisional hon. secretary, Mr. F. H. Smethurst at 118 New Kent Road, S.E.1.

## *Novel Form of Shop Lighting*

AN unusual lighting scheme is to be found in the lingerie shop of S. Weiss and Co., situate in Shaftesbury Avenue, London. Its novelty lies in the fact that the more conventional employment of lanterns and enclosures has been passed over in favour of bare cold-cathode tubes. The scheme will probably find many critics, but its efficiency is entirely satisfactory. Tubes of various lengths, complying with the layout of counters have been suspended 8½ ft high, giving an illumination of 30 lumens per sq ft. The form of suspension is best described by our illustration, but they have been made of ¼ in. solid rod in red and located at the junction of the tubes. Elliptical casings attached to the suspensions conceal the electrodes and are fitted with clips to support the horizontal portions of the tubes. All the tubes are in series so that connections to the power supply are made at the two extremities only and transformers have been grouped above the shop windows out of sight. The fittings were supplied by the G.E.C. whose illuminating engineering department collaborated with the architect in working out technical details of this installation.

*Equipment for the Brunswick Wharf power station made by F. W. Brackett and Co., Ltd., being loaded at Colchester for its sea and river trip to London. Cargo comprised 20 frame sections and a number of special fitments making up the water screen for condensers*

## *Poole Station open to Public*

POOLE'S new power station, which was opened earlier this year, is to be open to the public each Wednesday afternoon between 2 and 5 p.m. Making this announcement last week, the B.E.A. added the proviso that intending visitors must notify the Station Superintendent, 24 hours beforehand. These notifications can be done either by letter or telephone, but are necessary to ensure that arrangements can be made for a guide to be available.

## *Busy Season in N.W.*

REPORTS from the north-west indicate that the Area Board is exceptionally busy with its promotional campaigns. Earlier this month a large attendance at the Board's stand at the Royal Lancashire Show totalled more than at the two

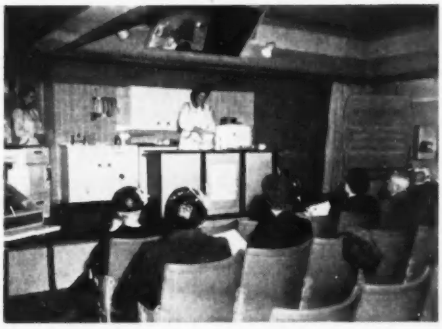
previous shows, and this in spite of a fall in the overall attendance at this annual event. The main marquee in this Board's stand housed farming domestic appliances and a model dairy, while two annexes were devoted to farm building equipment and horticulture. A special attraction was a barn hay-drying installation. Throughout the summer a decorated lorry has toured the area participating in a number of Festival celebrations. The lorry carries a display incorporating an animated hand working a switch and stressing the slogan "Electricity service lies in the Switch—so does its economy." In addition, the Board now has two mobile service centres in operation. The first was commissioned in March. Both have been visiting rural communities and have proved a successful venture.

## *NEWS IN BRIEF*

Wireless communication and navigational aid equipment installed in the English Electric "Canberra" for last week's record-breaking Atlantic flight was designed and manufactured by Marconi's Wireless Telegraph Co., Ltd.

The publication *Electricity Supply Statutes* as adapted or modified by The Electricity Act, 1947, by John W. Simpson and C. J. Hornsby has been recommended by N.A.L.G.O. and the Institute of Municipal Treasurers and Accountants in connection with their respective examinations dealing with Electricity Law. Copies can be obtained from Mr. J. W. Simpson at 16 Stratford Place, W.1. Price 15s. 7d.

British section of the Canadian National Exhibition at Toronto was opened on August 24 by Sir Charles Colston, chairman and managing director of Hoover Ltd.



*The London Electricity Board are providing demonstrations on cookery to housewives at the Tea Centre in Regent Street this month. The electric kitchen shown in our illustration includes a Jackson cooker, a Prestcold refrigerator, and Kenwood mixer*

The summer bulletin of British Insulated Callenders' Cables Ltd. is notable for its review of the company's contribution to the Festival Exhibition and particularly to the South Bank site. The foreword explains that, although the Skylon is prominent enough not to be overlooked, other work is hidden and may not be recognised as emanating from B.I.C.C.

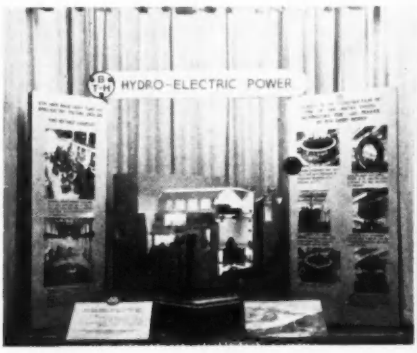
The first edition of its guide and list of members has been published by the Engineer Buyers and Representatives Association, 47 Victoria Street, S.W.1.

The report of the 17th Congress of Federation of Chambers of Commerce of the British Empire was published last week. The congress was held in London between June 11 and 15.

The Ministry of Fuel and Power has published its "Memorandum on the Coal Mines (Officials and Inspections) General Regulations, 1951." It is obtainable from H.M.S.O. at 1s.

The Liverpool Electric Cable Co. recently beat their associates, Frederick Smith and Co., in the annual inter-works bowls match and thus won the coveted "A. N. Smith" cup.

*Below is the current window display at British Thomson-Houston's premises in London which features a scale model of the Los Peares hydro-electric power station in Spain. The company were main contractors for generating plant, transformers and switchgear. Right is the Festival display in the windows of Brook Motors' Westminster office*



# Electric Supply News

**North Wales**

A warning against complacency among the opponents of the North Wales hydro-electric schemes was given by Mr. G. Haythornthwaite, vice-chairman of the Hydro-electric Protection Committee, last week. He said they had no reason to hope that the schemes would not proceed, and pointed out that trial-holes were being made. In all probability, only part of the scheme would be in the first bill, which may be presented in November. The Mawddach and Ffestiniog schemes would probably be the first to be dealt with, and the protection committee would petition against each bill as it came. In this connection they hoped to raise £5,000.

**Northumberland**

Some of the principal landowners in Northumberland have added their voices to protests being made at proposals for the erection of 60 miles of 275 kV transmission line from Stella power station to Carlisle. The Ministry of Fuel and Power is to conduct a hearing into the scheme at Newcastle-upon-Tyne on September 26, although many local bodies have asked for a public inquiry. An alternative scheme has been put forward but this would involve an additional expenditure of £72,000 on a project estimated to cost £1,300 a mile.

**Southern Board**

There is now more hope that new housing estates will be given a supply by the Southern Electricity Board. Difficulty had arisen recently in regard to houses at Slough, Winchester and Windsor, but now the Board are more hopeful that there will be some amendment of their allocation of £3,800,000 for the current financial year, we understand. It was due to insufficient funds that the Board had intimated to those councils that a supply could not yet be given. But negotiations were begun with Treasury officials, and there are strong hopes of finding a solution.

**Yorkshire**

In the year ended March 31 last, 875 farms were connected by the Yorkshire Electricity Board, and since then a further 310 have been connected. Owing to cuts in national expenditure, further progress is limited and the West Riding N.F.U. is preparing a survey of needs in rural areas.

## LIGHTING SCHEMES

**Bristol.**—The Public Works Committee has accepted in principle a proposal that the Festival illuminations—Clifton Suspension Bridge, Brandon Hill and Queen Square—should be an annual summer feature. The local firm, Gough Bros., responsible for lighting of the bridge, are to dismantle the equipment. Cost of this, plus re-erecting next year, will be £593. The city engineer reported that to illuminate Brandon Hill and Queen Square next year would cost £1,000.

**Maidstone.**—Consent has been received to the borrowing of £2,170 for improved lighting in Tonbridge Road, between the Broadway and St. Michael's Road, and between Milton Street and Farleigh Lane.

**Nelson.**—T.C. applying for sanction to borrow £1,583 for replacement of standards and renewal of wiring on the main road.

**Nottingham.**—The Ministry of Transport has now given approval for the provision of central sites for the installation of the new lighting scheme between Hucknall Road and Mansfield Road.

**Spenborough.**—U.D.C. to apply for sanction to borrow £12,000 for conversion of certain street lighting to electricity.

# Company Activities

**Berry's Electric Ltd.**

The year ended March 31 last resulted in a trading profit of £113,497 (*£84,464*), plus investment income, etc., £690 (*£751*). Depreciation, directors' emoluments, etc., absorb £25,091 (*£24,614*), to taxation £42,292 (*£31,402*), and to general reserve £32,351 (*£17,000*). Directors recommend an Ordinary dividend of 12½%, and there is a balance of £11,428 (*£10,062*) carried forward.

**T. Clarke & Co. Ltd.**

The directors of this old-established electrical contracting concern state that the business of the company and its subsidiary, T. Clarke and Co. (Liverpool) continues to expand and they consider it desirable to raise further capital on a permanent basis to finance the increased activities. Ordinary shareholders registered on August 30 are offered 154,538 Ordinary shares of 2s. at 4s. each in the proportion of one new for four shares held. These new shares will not rank for the interim dividend of 9% declared on July 25 last.

**Electric Furnace Co. Ltd.**

Consolidated trading profit for the year to March 31 last was £119,538 (*£75,683*), plus investment income, etc., £3,475 (*£9,216*), making a total of £123,013 (*£84,899*). Taxation absorbs £45,381 (*£33,004*), and after charging directors' emoluments, depreciation, etc., the balance is £83,054 (*£50,413*). To general reserve £30,000 (*£20,000*), and after payment of dividends, including final Ordinary of 5½%, there is a balance of £15,869 (*£13,403*) carried forward. Mr. D. F. Campbell, chairman, states that the extensions of the Burton-on-Trent works are approaching completion.

**Hackbridge Cable Holdings Ltd.**

Group trading profit for the year ended March 31 at £193,417 was £81,020 below that for the previous year. This figure was struck after allowing £35,327 (*£34,069*) for depreciation, etc. With taxation absorbing £122,170 (*£151,437*) the net profit is £71,247 (*£123,000*). Retained by subsidiaries is £10,843 (*£61,330*), and there is £3,524 (*£3,447*) carried forward. In his statement, Mr. C. I. Steen, chairman, says a good deal of thought was given by the Board to the final dividend, but it was their belief that the present setback should only be temporary. The future prospects will be entirely dominated by the raw material position. The turnover for the first four months of the current year has shown a substantial improvement over the corresponding period of last year. But this has been achieved at the expense of running down very considerably the normal stocks of raw materials.

**Jamaica Public Service Co.**

There is to be no dividend on the Common stock owing to the hurricane damage. (For many years this dividend has been 25 cents per share.) The president, Mr. R. D. Bell, says the hurricane inflicted considerable damage to some installations. Power stations were not seriously affected, but substantial damage was done, principally by falling trees, to the distribution system in Kingston and surrounding areas. Preliminary estimates of the cost of restoration and loss in earnings approaches the amount of one year's annual dividend on the Common stock.

**Morgan Crucible Co., Ltd.**

For the year to March 31 last, group trading profit was £1,612,433, compared with £1,230,019 for the previous year. Investment income makes the total £1,660,336 (*£1,263,128*). Taxation takes £902,956 (*£591,298*), and there is £200,000 placed to reserve. The final dividend of 1s. 9d. again makes a total distribution of 12½% for the year. Current assets total £5,378,342 (*£4,036,543*), and current liabilities and provisions £1,398,616 (*£1,326,612*).

**Palestine Electric Corporation Ltd.**

Net profit for 1950, including income-tax refund of I£22,314 on account of previous years, is I£208,620 (*I£170,689*). This is after all charges, including I£255,000 (*I£280,000*) for taxation, and after transferring I£125,000 (*same*) to general reserve. There is a dividend of 5% tax free on the £2,251,653 Ordinary and £800,000 "A" Ordinary shares as increased last March by a rights offer.

**Richardsons, Westgarth and Co.**

For the year ended March 31 last, the consolidated trading profit was £682,990 compared with £643,421 for the previous twelve months. To this is added sundry interest, £199 (*£2,699*). Depreciation absorbs £84,503 (*£82,108*) and taxation £356,900 (*£283,150*), and the sum of £935 (*£1,424*) is retained by subsidiaries, leaving the parent company's net profit at £240,851 (*£279,438*). The dividend is 12% (*same*) on increased capital, to general reserve £125,000 (*same*), superannuation reserve £25,000 (*£50,000*), leaving £133,449 (*£126,200*) carried forward. Group current assets are listed at £2,962,231 (*£2,306,684*), including work in progress, less instalments received, £1,464,076 (*£1,347,582*). Current liabilities amount to £1,117,560 (*£1,072,416*).

**Scottish Cables (South Africa) Ltd**

The abridged results for the first trading year ended June 30 last, show a trading profit of £123,005. Directors' fees and depreciation absorb £22,526, leaving £100,479. To taxation and preliminary expenses £33,059, proposed 5% dividend £30,000, and transferred to general reserve £30,000, leaving £7,420 carried forward. The directors have chosen November 30 next as an appropriate date for payment of the dividend, to enable the shareholders of Rhodesian Cables to secure registration of the shares to which they become entitled.

**Reason Manufacturing Co.**

For the year to January 31 last, the profit amounts to £4,148 (*£4,145*). To taxation £769 (*£375*) and tax reserve £521 (*nil*). The Ordinary dividend is again 20%, and the sum of £15,574 (*£14,616*) is carried forward.

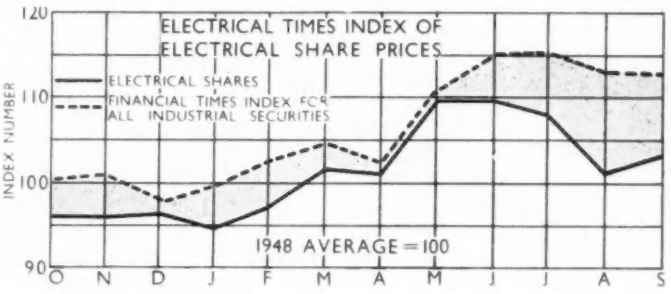
**Superheater Co. Ltd.**

The authorised capital is to be raised to £750,000 by the creation of 600,000 new "A" Ordinary shares of 5s. each. The directors state that this does not forecast any immediate issue.

**Dividends Declared**

*Walsall Conduits Ltd.*—Interim of 20% (*same*), payable on October 1.

*Crofts Engineers* (*Holdings*).—Interim of 15% (*same*), payable on September 28.




*Electrical shares showed an upward trend at the end of August, while all industrial shares fell slightly. The "Electrical Times" index rose from* **100.8** *to* **103.6**, *and the "Financial Times" figures for all industrial shares fell to* **112.8**, *a drop of* **0.2** *only. Figures are based on average prices ruling during* **1948**

# Commercial Information

## HOME

**Sept. 7.—Manchester.** Installation of fully automatic intercommunication telephone system at "Newholme," West Didsbury. City Architect, Town Hall. Deposit £1 1s. (See Aug. 23 issue.)

**Sept. 8.—Greenock T.C.** Electrical installation in erection of 73 houses in Cotton Mill Row area. Applications to John Liddell, Town Clerk, Municipal Bldgs., by above date.

**Sept. 10.—Dundee T.C.** Trustees of Harbour require supply of electrical fittings for ensuing six or twelve months. Alexander Smith, General Manager and Engineer, Dundee Harbour Trust, Harbour Chambers, Dock Street.

**Sept. 10.—Newcastle - under-Lyme R.D.C.** Electric wiring for 38 houses and 6 bungalows at Meg Acre, Wood Lane, and Station Rd., Halmerend; and 42 houses and 4 bungalows at Wereton, Audley and Alsagers Bank. Architect, A. P. Lovatt, 6 King St., Newcastle.

**Sept. 10.—N. Walsham (Norfolk) U.D.C.** Installation of about 350 light points in houses on Millfield estate. J. A. Yates, surveyor, Council Offices, New Road. Deposit £1 1s.

**Sept. 10.—Oldham T.C.** Supply of concrete lamp columns and lanterns for Group B street lighting. C. Warwick, Lighting Superintendent, Gas St. (See Aug. 16 issue.)

**Sept. 10.—Romford.** Provision and erection of 9 street lighting units in Heaton Way and Heaton Close. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

**Sept. 10. — Ryton - on - Tyne U.D.C.** Electric lighting and heating in 56 houses on Garden House estate, Crawcrook. Surveyor, Council Offices, Ryton Tower, Ryton.

**Sept. 10.—Wrexham R.D.C.** Wiring for electric light and power in 53 houses on Plas Kynaston site at Cefn. Engineer and Surveyor, E. Edwards, Imperial Bldgs., Regent St. Deposit £2 2s.

**Sept. 11.—Dundee T.C.** Waterworks invites tenders for electrification work at Main, South and North Lodges, Monikie. G. Little, Engineer and Manager, Corp. Waterworks, 17 City Sq.

**Sept. 12.—Dewsbury T.C.** Electrical installation in 100 houses on Chickenley Lane estate. Borough Architect and Buildings Surveyor, Town Hall.

**Sept. 12.—Spenborough U.D.C.** Electrical work in erection of 8 houses at Gomersal. Architects, Howorth, Walker and Lilley, Albion Chambers, Cleckheaton.

**Sept. 13.—Glasgow.** Electrical installation in 267 flats in Berryknowes Rd. Director of Housing, 2nd Floor, 20 Trongate, Glasgow C.1. Deposit £3 3s.

**Sept. 14.—Belfast.** Supply and erection of automatic fixed-type $CO_2$ fire fighting installations. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (See Aug. 9 issue.)

**Sept. 14.—Belfast.** Supply and erection of ash handling plant of high pressure sluicing type capable of removing 45-50 tons per hour, for Victoria power station. Merz and McLellan, Carliol House, Newcastle-on-Tyne 1. Deposit £5 5s. (See Aug. 2 issue.)

**Sept. 14.—Lanark.** Internal rewiring at Lockhart Hospital. Henry K. Mitchell, secretary-treasurer, Board of Management, Law Hospital, Carluke.

**Sept. 14.—Sheffield.** Electrical installation in 822 dwellings on Basegreen estate. W. Geo. Davies, City Architect, Town Hall. Deposit £1.

**Sept. 14.—Tavistock U.D.C.** Installation of improved standard of street lighting for main roads and shopping centre. Specification from Council's Surveyor, H. F. Robinson, Council Chambers, Drake Rd. Deposit £2 2s. Tenders to S. G. Jenkins, Clerk of Council, at same address.

**Sept. 14.—West Riding.** Electrical installation in adaptation of "The Elms," Bond St., Wakefield. County Architect, "Bishopgarth," Westfield Rd., Wakefield.

**Sept. 15.—Clare R.D.C.** Electric wiring of ten houses at Little and Great Bradley. Council's Engineer and Surveyor, Stonehall, Clare, Sudbury, Suffolk.

**Sept. 15.—Merthyr Tydfil T.C.** Electrical installation in Twynyrodyn infants, Pant junior, and Gellifaellog junior, mixed and infants' schools. Borough and Waterworks Engineer, Town Hall. Deposit £2 2s. (See Aug. 23 issue.)

**Sept. 15.—Merthyr Tydfil T.C.** Electrical work in Penydarren, Abermorlais, Webster St. and Mount Pleasant junior and infants' schools. Borough and Waterworks Engineer, Town Hall. Deposit £2 2s. (See Aug. 23 issue.)

**Sept. 15.—Rutherglen T.C.** Electrical work in erection of three blocks of flats. Applications by above date to J. C. Russell, Burgh Surveyor, Town Hall Buildings.

**Sept. 17.—Whitley Bay U.D.C.** Installation of complete system of sodium street lighting in Earsdon Rd. E. Roberts, Borough Surveyor, Council Offices. Deposit £2 2s.

**Sept. 18.—West Riding.** Installation of electricity at secondary school at Skipton. County Architect, "Bishopgarth", Westfield Rd., Wakefield.

**Sept. 19.—Douglas (I.O.M.) T.C.** Laying of h.v. and l.v. cables, beginning at end of month. Borough Electrical Engineer and Manager, Electricity Offices, Ridgeway St., Douglas.

**Sept. 22.—Blackpool T.C.** Supply of 350 concrete columns, lanterns, chokes and capacitors for Group A street lighting; 100 same for Group B, and 500 synchronous time switches with solar dials. Public Street Lighting Officer, Electrical Services Dept., Rigby Rd. East. (See Aug. 23 issue.)

**Sept. 22.—Fife.** Electrical work in sub-divisional police station at Burntisland. Surveyors, Robt. Galbraith and Lawson, 21 Crossgate, Cupar.

**Sept. 24.—Manchester.** Installation of electrically operated sluice valves included in contract N.3 for Corp. Waterworks. Secretary, Waterworks Office, Town Hall. Deposit £10.

**Sept. 26.—Gosforth (Northumberland) U.D.C.** Installation of electricity in 18 flats in Graham Park Rd. Surveyor is Clifford Wyld.

**Sept. 27.—Coventry.** Electrical installation in first of four hostel blocks at training college. Applications to W. L. Chinn, Director of Education, by Sept. 7. Deposit £1 1s.

**Sept. 29.—Bristol.** Supply and installation of sewage pumping plant which includes electric motor, switchgear, etc. J. B. Bennett, City Engineer, Arno's Court, 470 Bath Rd., Brislington, Bristol 4.

**Oct. 1.—Acton.** Installation of street lighting in Western Ave. Borough Engineer, Town Hall, Acton, W.3.

**Oct. 1.—Bradford.** Supply and erection of 4 automatically-controlled, electrically driven pumping units, two with capacity of 1,400 g.p.m. and two 4,200 g.p.m. Sewage Works Engineer and Manager, Esholt Hall, nr. Shipley. Deposit £2 2s.

**Oct. 2.—Leyton T.C.** Provision, wiring and fixing of lighting in public hall, Town Hall. Further details and documents from Borough Engineer and Surveyor, Town Hall, E.10. (Advertised in this issue.)

**Oct. 3.—Chichester.** Supply and erection of five automatically controlled electrically driven pumping units and auxiliaries. Water Engineer's Office, Greyfriars, North St. Deposit £2 2s.

**Oct. 3.—Downpatrick T.C.** Supply and installation of 9 direct-driven centrifugal, electrically propelled pumps for town's sewage scheme. M. J. Hayes, Town Clerk, U.D.C. Offices. Deposit £5 5s.

**No date stated.—Rothesay.** Installation of electricity in block of 4 houses for Scottish Veterans' Garden City Assoc. J. H. Chilcott, gen. sec. of assoc., Manor Place, Edinburgh.

## OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

**Sept. 18.—Wellington (N.Z.)** State Hydro-Electric Dept. invites tenders for some 38,970 yd. of power and control cables, 50,000 yd. of switchboard wire and 44 cable boxes. Dept.'s Stores Manager, Box 8025, Govt. Bldgs., Wellington. B.o.T. (Ref: CRE(IB) 68994/51).*

**Sept. 24.—Argentine.** Supply of lead covered armoured ground cable for Min. of Industry and Commerce, Electric Energy Dept. Tenders to office in Lavalla 1556, Buenos Aires.

**Sept. 28.—Uruguay.** Supply of a total of over 500,000 incandescent lamps for working voltage of 230 V required by Usinas Electricas y los Telefonos del Estado, Seccion Adquisiciones, Julio H. y obes 1470, Montevideo. B.o.T. (Ref. CRE (IB) 68184/51).*

**Oct. 8.—Argentine.** Supply of seven centrifugal, vertical axle electric pump units, one centrifugal horizontal axle electric pump unit, two metal protected low voltage switchboards, one high voltage switchboard, one Venturi type meter, one hand-controlled overhead travelling crane, and four three-phase transformers for Min. of Public Works. Tenders to Gen. Administrative Secretariat, Chareas 1840, Buenos Aires.

**Oct. 22.—India.** Supply of l.t. switchgear for Mysore Forbes transformer station for Govt. of Mysore. Stores Purchase Committee. B.o.T. (Ref.: CRE (IB) 69156/51).*

**Oct. 30.—Argentine.** Ministry of Economy invites tenders for construction of a thermo-electric plant and a steam plant and pipes. Further details available from Technical Equipment Office, San Martin 447, Buenos Aires.

**Nov. 1.—India.** Supply of 5 drilling machines with electrical fittings and equipment, to various specifications, for Directorate General of Supplies and Disposals, Shahjahan Rd., New Delhi. B.o.T. (Ref: CRE (IB) 69126/51.)*

**Nov. 6.—Egypt.** Supply and erection of Cairo 63 kV underground cable system and associated transformer and switching stations for Cairo Electricity and Gas Administration. Documents available from Chief Inspecting Engineer, Egyptian Gvt., 41 Tothill St., S.W.1. Deposit £10 5s. (plus same for album of drawings). Ref. No. 30/Elec. and Gas. 3-2-208. (Advertised in this issue.)

**Nov. 12.—Uruguay.** Supply of some 134,300 metres covered h.t. cables between 15,000 V and 220 V with accessories, jointing boxes, terminal boxes, etc. Usinas Electricas y los Telefonos del Estado, Julio Herrera y Obes, Montevideo. B.o.T. (Ref.: CRE (IB) 69233/51).*

**Feb. 5, 1952.—New Zealand.** Hydro-Electric Dept. invites tenders for manufacture and supply of one 10,000 kVA 11 kV synchronous condenser for Invercargill substation. Deposit £(NZ)100. Documents available from N.Z. Gvt. offices in London.

## *Your Queries — Answered*

**"Burman" clippers,** makers of? R.B.—Burman and Sons, Ltd., Ryland Rd., Birmingham 15. (21317)

**"Progress" drills,** makers of? E.B.—B. Elliott and Co., Ltd., Victoria Rd., Willesden, N.W.10. (21329)

**"Intermains" intercom unit,** makers of? D.W.—E. Shipton and Co., Ltd., Ferndown Works, Northwood Hills, Middx. (21341)

**"Zeros" refrigerators,** spares for? E.B.—Time Engineers, 60 Southend Rd., Rainham, Essex. (21348)

**"Botrade" switchfuse,** makers of? L.E.—Bill Switchgear Ltd., 53 Aston Lane, Perry Barr, Birmingham 20. (21359)

**"Formvar" enamelled wire,** makers of. T.E.R.—This name refers to the covering material only which is produced by Shawinigan Ltd., Marlow House, Lloyds Ave., E.C.3. The covered wire is supplied by many firms. (21364)

**"Smithson" mechanical contactors,** makers of? E.D.—J. G. Smithson and Co., Ltd., Factory Centre, Kings Norton, Birmingham 30. (21379)

*The above are selected from questions we have answered this week. If you have a query, send it to us.*

## CONTRACTS PLACED

**Boldon (Durham) U.D.C.** Supply of electric cookers for future housing schemes, General Electric Co.

**Golborne (Lancs.) U.D.C.** Supply and erection of street lighting equipment along approximately 2½ miles of Warrington-Leigh Rd., N.W. Electricity Board, £5,541.

**Goole T.C.** Installation of H.P.M.V. sodium and tungsten lighting on various roads, G.E.C., London.

**Inverkeithing T.C.** Provision and erection of some 85 columns, lamps and lanterns along a number of roads, Eastern Electric Service Ltd., £3,524.

**Kent.** Electrical services at Fort Horsted in adaptation to technical college, Pinching and Walton Ltd., £33,111.

**London.** Supply of lamps to Trinity House for year ending June 30, 1952, Thorn Electrical Industries, Ltd.

**March (Ely) U.D.C.** Wiring of 42 houses on Peashill estate, Eastern Electricity Board, £1,124.

**Newbiggin-by-the-Sea U.D.C.** Supply and erection of 95 standards, lamps and lanterns on various roads, B. L. Oliver.

**Newcastle-under-Lyme T.C.** Installation of street lighting on various estates, British Thomson-Houston Ltd., £7,429. Also electrical installation at Hempstalls Farm School, J. Bagguley and Son, £2,214.

**Reading T.C.** Electrical work in Oxford Rd. primary schools, Herbert and Lascelles Ltd., £1,150.

## TRADE NOTES

**New Branch.** The Sun Electrical Co., Ltd. have opened a new branch at 15 Sydenham Road, Guildford, Surrey, under the management of Mr. J. Firmin.

**New London Office.** A.B. Metal Products Ltd. have moved their London office to 16 Berkeley Street, W.1. Telephone: Grosvenor 5206-7.

**Showroom.** Drubel Distributors Ltd. are formally opening a new lighting showroom at 19-21 Stafford Road, Croydon on Sept. 19.

**Change of Address:** Smart and Brown (Engineers), Ltd. are moving their London sales office and trade counter, as from Sept. 24, to 8 Rose and Crown Yard, King St., St. James St., S.W.1. Tel.: Whitehall 8267-8. The manager is Mr. R. V. Broderick.

**PRICES OF CABLE METALS AND OTHER MATERIALS**
*(at Tuesday night)*

| | £ s. d. | New York price |
|---|---|---|
| COPPER, electrolytic ... ... ... | 234 0 0 | £220 0 0 |
| LEAD, good soft pig (foreign) ... ... | 180 0 0 | 136 0 0 |
| ,, ,, ,, "English" quality | 181 10 0 | |
| Tin (99-99.75—) ... ... ...(Cash) | 930-935 | — |
| ,, (3 months) ... ... ... ... | 885-887½ | — |
| ALUMINIUM, commercial purity (del.) | 124 0 0 | — |
| ZINC ... ... ... ... ... | 190 0 0 | 140 0 0 |
| ARMOURING: | | |
| Galv. Steel Wire (0.104 in.) ... ... | 55 5 0 | — |
| Mild Steel Tape (0.04 in.) ... ... | 32 5 0 | — |

## GAZETTE ANNOUNCEMENTS

### COMPANIES ACTS

**Cornwall Radio and Television Co. Ltd.** Meeting of members to be held at 1 Beachfield Ave., Newquay, on Oct. 3 at 11 a.m. to receive liquidator's report.

**Electro-Metals Ltd.** Resolution for voluntary winding-up passed at meeting on Aug. 22. Reginald W. West, 6 Broad St. Place, E.C.2, was appointed liquidator to whom creditors should send particulars by Sept. 28.

**Ranalagh Ltd.** Petition for winding-up presented on Aug.27 and is directed to be heard at Royal Courts of Justice on Oct.8. Interested parties should communicate with Beale and Co., 22 Gt. Smith St., S.W.1.

**G. L. Scott and Co. Sales Ltd.** Resolution for voluntary winding-up passed at meeting on Aug. 27 and Robert G. Wallis, 69 Fleet St., E.C.4, was appointed liquidator.

**S.I.M. Electrical Co. Ltd.** Meeting of creditors will be held at 10 Peacock Lane, Leicester, on Sept. 24 at 11 a.m.

*Partnerships Dissolved*

**Knaresborough.** Kenneth Tinker, Douglas P. Tinker and John A. Wilson trading as "Tinker and Blakeson," electrical and radio contractors and dealers, at 25 High St., Knaresborough. Partnership dissolved as from Aug. 24. All debts received and paid by Kenneth Tinker who will continue business under same name.

**Wolverhampton.** John Thomas Jarvis, James Theodore Jarvis and Harold Moulding, trading as "J. T. Jarvis and Son," electrical engineers, at 59 Bell St., Wolverhampton. Partnership dissolved as from Aug. 23. All debts paid by John T. Jarvis and James T. Jarvis, who will continue the business.

*Appointment of Liquidators*

**London.** Gordon Refrigeration Co. Ltd., London W.11. Reginald Harrop of 24 Portland Place, W.1, has been appointed liquidator with a committee of inspection.

**London.** Jerome K. Jerome (Gosport) Ltd., wireless and electrical engineers. A. W. Hunter, 185-188 High Holborn, W.C.1, has been appointed liquidator with a committee of inspection.

### BANKRUPTCY ACTS

*Release of Trustee*

**Huddersfield.** Harold Winkley, electrician at 37 and 41 Wakefield Rd., Huddersfield. Trustee was Percy Cardwell, 93 Queen St., Sheffield.

*Dividend*

**London.** Hyman Gold, radio and electrical engineer trading as "Goldway Electronics" at 141 Park Rd., St. John's Wood, N.W.8. First and final dividends of 1s. 10½d. in £ payable at office of trustee, 185-188 High Holborn, W.C.1, today (Thursday).

*Order varying Order made on Application for Discharge*

**London.** Robert T. H. Brimfield, electrical contractor, trading as "Richfield Electrical Components," at 73 High Holborn, W.C.1. Discharge suspended for three years from Dec. 12, 1942 provided bankrupt pays £240 p.a., or half his yearly income after tax deductions, whichever is greater, to Official Receiver until creditors have received 5s. 3$\frac{15}{16}$d. in £. Payments to begin Nov. 23.

# BUSINESS PROSPECTS

## HOME

**Airdrie T.C.** Tenders expected to be invited shortly for erection of 36 houses and a church at Craigneuk.

**Belfast.** Smyth and Dorman and Partners, 31 College Gdns., are architects for buildings to be erected at Girdwood Park for Territorial Army at estimated cost of £250,000. Also erection of two blocks containing 5 shops and 10 flats on Highfield estate. Housing Architect, 94 Chichester Street.

**Bethnal Green.** Erection of 51 flats in Lansdell Place area. Applications to the Town Clerk, Town Hall, E.2.

**Bournemouth T.C.** Construction of 28 dwellings on Stourfield estate. Borough Architect, Town Hall.

**Brigg R.D.C.** Stage lighting to be installed at the Corn Exchange at estimated cost of over £500. Scheme being prepared by G. Mostyn Lewis, county drama adviser for Lindsey, Lincs.

**Burnley T.C.** Start will probably be made shortly on erection of a school in Whittlefield area.

**Byers Green (Durham).** It is proposed to rewire the Byers Green Workmen's Club and Institute and clubhouse. Secretary is J. W. Forrest, Workmen's Club, North Street.

**Cardiff R.D.C.** Erection of 62 dwellings at Diras Powis, 40 at Rhoose, 18 at Creigian and 8 each at Rudry and Rhydygwern. S. P. Youldon, engineer, surveyor and architect to Council, 20 Park Place, Cardiff.

**Chatham T.C.** Erection of 28 flats at Jenkins Dale. H. D. Peake, borough engineer and surveyor, Town Hall.

**Crook and Willington U.D.C.** Erection of 34 houses at Low Willington. T. A. Page, Son and Hill, 75 King St., South Shields.

**Cuckfield (Sussex) U.D.C.** Erection of 18 houses in three blocks at Haywards Heath. Council's Surveyor, R. J. Willett, Council Offices, "Oaklands," Haywards Heath.

**Cumberland.** C.C. is to spend some £2,580 on installation of electricity in a number of schools and schoolhouses. County architect is J. H. Haighan, Portland Sq., Carlisle.

**Darlington T.C.** Erection of 38 houses on Springfield site. E. A. Tornbohm, Borough Architect, Central Bldgs.

**Devizes T.C.** Construction of 20 houses on Home Farm estate. J. D. Sheasby, Borough Surveyor, The Chequers.

**Dundee T.C.** British Oxygen Co. Ltd. are planning to build a factory on Milton of Craigie industrial estate.

**Dungannon (Co. Tyrone) R.D.C.** Scheme approved for erection of 200 houses at an estimated cost of £200,000.

**Durham R.D.C.** Application to be made for sanction to borrow £69,500 for erection of 30 houses at Belmont, 20 at Wilton Gilbert and 12 at Leamside. Site works also being planned for 123 houses at Bowburn. 12 houses also to be built in Church St.

**Ellesmere Port (Cheshire) U.D.C.** Approval received for building of civic hall at cost of £100,000. Tenders to be invited soon.

**Failsworth U.D.C.** Erection of 28 houses in Greaves Ave. Engineer and Surveyor, Town Hall, Oldham Rd.

**Gateshead T.C.** It is proposed to build another 50 houses on Cedars estate.

**Hebburn-on-Tyne U.D.C.** Erection of 16 houses on Hartleyburn housing extension. R. C. Bestow, engineer and surveyor, Council Offices, Argyle St.

**Littlehampton U.D.C.** Construction of 12 houses for Wickbourne scheme. J. A. Young, engineer and surveyor, Council Offices, Manor House.

**London.** Licence valued at £2,716 has been granted to Frederick Hotels Ltd. for replacement of existing lifts by four electric passenger lifts, together with conversion of the present electric lift at Hotel Russell from d.c. to a.c. Also plans prepared for block of flats in Sussex Gdns., Paddington, for Grand Junction Co. Architects are Thomas and Thomas, 142 Sussex Gdns., W.2.

**Long Ashton (Bristol) R.D.C.** Erection of 14 houses and 8 bungalows at Long Ashton, Pill and Wraxall. Maynard, Froud and Stevens, architects, St. Stephen's Chambers, Baldwin St., Bristol.

**Mansfield Woodhouse U.D.C.** Erection of 20 bungalows in Park Rd. Council's Surveyor, Council Offices, Manor Hse.

**Motherwell T.C.** Dean of Guild Court has approved erection of 36 houses in Coursington Rd. and Wilson St., and 20 at Wishaw.

**Morpeth R.D.C.** Erection of 26 houses on Hadstone estate. Surveyor is J. R. Miles, Dacre St., Morpeth.

**Newcastle-on-Tyne.** M. Gatoff, Trafalgar St., is architect for new factory in Condercum Rd. for St. James' Products Ltd.

**Newcastle - under - Lyme T.C.** Tenders likely to be invited in near future for rewiring of electrical installation at public health offices in Queen St.

**Northampton T.C.** Erection of 26 and 18 houses in two contracts at Sunnyside. Borough Architect, Guildhall.

**Peterlee (Durham) T.C.** Alexandre Ltd. have received permission to extend their factory. Amour Laboratories Ltd. (London) are planning a factory, and Billetop and Gilpin (Leicester) are also considering the erection of a factory in this district.

**Plymouth.** Erection of primary school at Lipson. Applications to architects, Louis de Soissons and Partners, 5 Portland Sq.

**Preston T.C.** Construction of 144 flats on Larches estate. Borough Surveyor, Municipal Building. Approval received for erection of primary school at Kibbleton. Cost is estimated at £106,510.

**Rotherham R.D.C.** Application to be made for sanction to borrow £33,308 for 26 houses at Catcliffe and Brinsworth.

**Shotley Bridge (Durham).** Newcastle Regional Hospital Board is considering modernisation of a block at local hospital. Board is at "Dunita," Osborne Rd., Newcastle.

**Skipton (Yorks) R.D.C.** Application to be made for sanction to borrow £800 for installation of electricity in 32 houses on Hebden Rd. site, Grassington.

**Southend T.C.** Erection of junior section of Temple Sutton primary school in Eastern Ave. Borough Architect, Municipal Bldgs., 30 Alexandra Street.

**South Kirkby (Pontefract).** Plasticisers Ltd. (E. and G. Slack Ltd.) of Bradford propose to build a factory in this area.

**Welshpool T.C.** 38 houses to be built at Borfa Green.

**Wicklow.** It is proposed to build 42 houses and 22 cottages at Kindlestown.

*Business Prospects continued.*

## OVERSEAS

**Peru.** Senores Jaime and Efrain Tejada S. C. De R. Ltda., of Avenida Quiroz, 200 (Casilla 624) Arequipa, would like quotations from U.K. manufacturers for 8 ft. lathe coupled to electric motor for operation on 110 V a.c. and 220 V a.c. 50 c/s complete with accessories.

**New Zealand.** N. A. Sherwood and Co., 34 Victoria St. West, Auckland, wish to represent U.K. manufacturers of washing machines, electric hedgeclippers and other domestic appliances.

# TRADE MARKS

*This information is extracted from the Official Journal by permission of the Controller.*

**Discus.** 697,175. Class 9. Automatic apparatus for playing gramophone records. Birmingham Sound Reproducers Ltd., Claremont Works, Old Hill, Staffs.

**Divatel** 699,264. Class 9. Radio apparatus. Westrex Corpn., 111 Eight Ave., New York, N.Y.

**Ferrosil.** B698,537. Class 9. Telephone diaphragms. Richard Thomas and Baldwins Ltd., 47 Park St., W.1.

**Guardion.** B698,724. Class 9. Electrical instruments and apparatus. F. A. Hughes and Co., Ltd., Bath House, 82 Piccadilly, W.1.

**Hitest.** 684,937. Class 9. Insulated electric wire and electric cables. Falk, Stadelmann and Co. Ltd., Veritas House, 91 Farringdon Rd., E.C.1.

**Impulsionel** 699,774, and **Impulsionnel,** 699,775. Class 9. Electronic apparatus for generating electrical impulses. Ateliers de Contructions Electriques de Charleroi, 33 Rue de Congres, Brussels, Belgium.

**Seraph.** 699,466. Class 9. Electrical and scientific instruments and apparatus, and wireless sets (complete). Donald Simpson Robson, Stenk Villa, Abbeytown, Carlisle.

**Suratel.** 699,371. Class 9. Suppressors for the prevention of interference with television and radio receivers. Wolf Electric Tools Ltd., Pioneer Works, Hanger Lane, Ealing, W.5.

**Transbooster.** B694,000. Class 9. Voltage regulating apparatus. Westinghouse Brake and Signal Co. Ltd., 82, York Way, King's Cross, London N.1.

# NEW COMPANIES

*Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.*

*Companies Limited by Guarantee*

**Institute of Metal Finishing, Incorporating Electrodepositors Technical Society Ltd.** Income and property of Institute, whencesoever derived, shall be applied solely towards the promotion of its objects. Council: A. W. Wallbank, Chenda, Bittell Rd., Barnt Green, Worcs.; Dr. S. Wernick, F. L. James, Dr. G. E. Gardam, A. W. Hothersall, R. A. F. Hammond, W. E. Wright and 14 others.

**Incorporated Practical Radio Engineers (I.P.R.E.) Ltd.** Income and property of the Association, whencesoever derived, shall be applied solely towards the promotion of its objects. Council: C. H. Gardner, 214 St. Margarets Rd., Twickenham, J. F. Tomlin, T. E. Fevyer, G. F. Loos, S. H. Burchill, W. Edwards and A. J. Maybank.

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**Bankfield Engineering (Electronics) Ltd.,** 1, Hoghton St., Southport, Lancs, wholesalers and retailers of electronic and electrical equipment as used in radar, radio television and communications industries, etc. Cap.: £1,000. Dirs.: D. W. Beaver and W. Smith.

**G. H. Bowen, Ltd.** Chemical, mechanical, electrical, hydraulic, heating, ventilating, domestic and general engineers, etc. Cap.: £10,000. Permt. Dirs.: G. H. Bowen and Mrs. E. Bowen, 202 Rolleston Rd., Burton-on-Trent, and J. Bowen.

**Central Electric Co. (Liverpool) Ltd.,** 33, The Temple, "C" Building, Dale St., Liverpool. Wireless, television, telephonic and telegraphic engineers, etc. Cap.: £2,000. Dir.: R. J. Keeley.

**Insulex Mineral Products Ltd.,** 15 Cullum St., E.C.3. Manufacturers of materials used for the purposes of thermal, sound or electrical insulation, insulation contractors, etc. Cap.: £6,000. Dirs.: J. D. Blakeley, E. C. W. Smith and Mrs. G. J. Foster.

**I. V. Pressure Controllers Ltd.** Metal makers and workers, mechanical, motor, electrical, hydraulic, marine and civil engineers; manufacturers of and dealers in pressure controllers, etc. Cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Z. Z. Gadowski, 29 Gloucester Cres., N.W.1, and S. W. Hoskins.

**Northern Wholesale Electrical Distributors Ltd.,** 66 John St., Sunderland. Cap.: £2,000. Dirs.: D. B. Sonley, G. F. Fenwick, and T. Fenwick.

# MEETINGS TO NOTE

### THURSDAY, SEPT. 6

INCORP. PLANT ENGRS. (Peterborough Branch).—"Cutting Tool Dynamometry as an aid to Machine Tool Maintenance." J. Purcell. E. Gas Board, Church St., 7.30 p.m.

### MONDAY, SEPT. 10

A.S.E.E. (Central London Branch) —"The Engineer and the Welfare State." R. F. Mathieson. St. Ermin's Hotel, Caxton St., S.W.1, 7 p.m.

### TUESDAY, SEPT. 11

A.S.E.E. (S.W. London Branch). —"Mercury Arc Rectifiers." C. H. Brown. St. George's Hall, St. George's Rd., Wimbledon. 8.15 p.m.

INCORP. PLANT ENGRS. (S. Wales Branch).—"Modern Applications of Rubber in Industry." Inst. of Engrs., Park Place, Cardiff, 7.15 p.m.

INCORP. PLANT ENGRS. (Glasgow Branch).—"Electronics in Production." Engrg. Centre, 351 Sauchiehall St., 7 p.m.

### WEDNESDAY, SEPT. 12

A.S.E.E. (Bradford Branch).—"Modern Factory Lighting." A. G. Smith. Midland Hotel, 7.30 p.m.

### THURSDAY, SEPT. 13

INCORP. PLANT ENGRS. (Kent Branch). —"Electric Motors — Characteristics and Application." Speaker not named. Queens Head, Maidstone, 7.30 p.m.

INCORP. PLANT ENGRS. (Newcastle Branch).—"Pulverised Fuel." R. R. Bettle of Babcock and Wilcox Ltd. Roadway House, Oxford St., 7.30 p.m.

### FRIDAY, SEPT. 14

ELEC. TRADES' COMM. TRAVELLERS' ASSOC.—General meeting at Feathers Hotel, Broadway, S.W.1, followed by "Any Questions." 6 p.m.

A.S.E.E. (Bristol Branch).—"Development of Clyde Passenger Steamer." A. S. Miller. Grand Hotel. 7.30 p.m.

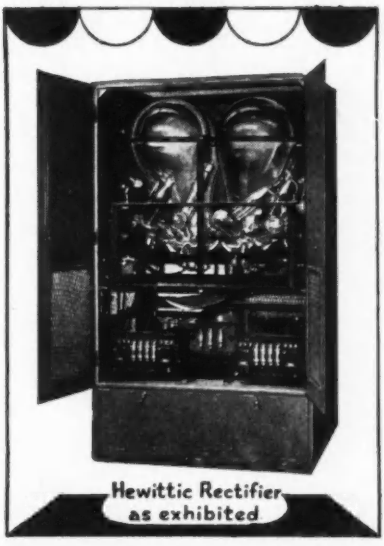
A.S.E.E. (Crewe Branch).—"Limitations of Science." J. Levitt. Crewe Arms Hotel, 7.30 p.m.

A.S.E.E. (Nottingham Branch).—"Power Cable Design." F. V. Howitt. Old Angel Inn, Stoney St., 7.30 p.m.

### SATURDAY, SEPT. 15

TRAVELLING EXHIBITION. Opens at Nottingham, the final stage of journey, continuing until Oct. 6.

HERE in the General Electronic Section under the Dome of Discovery you will find a fine example of a modern electronic power unit—the Hewittic mercury arc rectifier—the equipment used for all forms of D.C. electric traction, light and power, and heavy duty industrial supply.

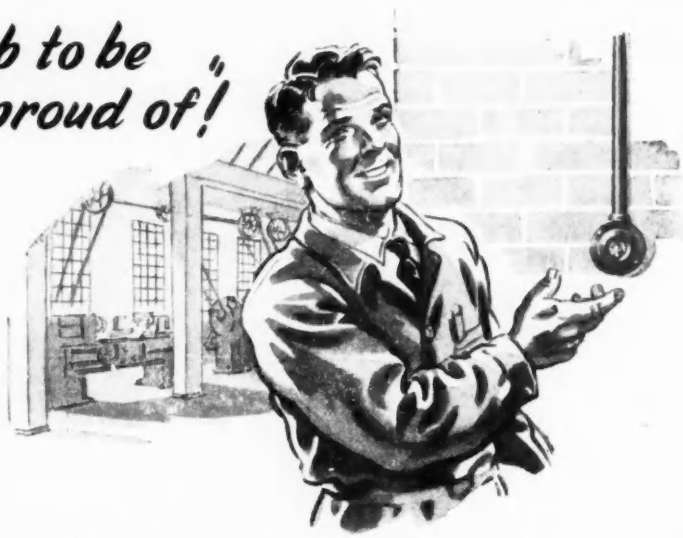



Hewittic Rectifiers
REGD. TRADE MARK

HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD., WALTON-ON-THAMES, SURREY

*Telephone: Walton-on-Thames 760 (8 lines) Telegrams: "Electric," Walton-on-Thames*

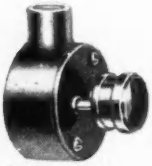
"A job to be proud of!"



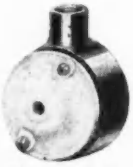
What satisfaction in a job well done. It is *inevitable* with Metallic quality and consistent accuracy.

Screwed and Socketed Conduit Thread.

Sunk-type Switch Iron Cover.



Sunk-type Plug Fitting Iron Cover.



Direct Mounting Flat-type Ceiling Rose.

*It always pays to SPECIFY* METALLIC

# CONDUIT TUBE & FITTINGS

A TI COMPANY

**THE METALLIC SEAMLESS TUBE Co. Ltd., Ludgate Hill, BIRMINGHAM 3. Tel. CEN 7167**

**Also at London, Newcastle-on-Tyne, Leeds, Swansea and Glasgow**

# CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. 0d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

## TENDERS INVITED

### EGYPTIAN GOVERNMENT

TENDERS are called for by the Director General, Cairo Electricity and Gas Administration, for the supply and erection of Cairo 63 kV underground cable system and associated transformer and switching stations.

Tenders should be submitted to: The Director General, Cairo Electricity and Gas Administration, 53 Sharia Fouad 1, Cairo, Egypt, not later than noon on November 6, 1951.

Copies of the necessary conditions of tender, specification, etc., can be obtained on application to the Chief Inspecting Engineer, Egyptian Government, 41 Tothill Street, London, S.W.1, against remittance of £10 5s. per copy of specification and conditions of tender, and £10 5s. per album of drawings, which sum must be prepaid and is not returnable. Copies of these documents are also available for scrutiny at the above address. Cheques must be endorsed permitting transfer to an Egyptian Government account.

Reference No. 30/Elec. and Gas 3-2-208 must be quoted in all correspondence. (M 7)

### BOROUGH OF LEYTON

LIGHTING OF PUBLIC HALL—TOWN HALL, LEYTON

TENDERS are invited for the provision, wiring and fixing of lighting at the above Public Hall.

Contractors who desire to tender for this work will be required to produce a scheme providing for suitable decorative fittings incorporating three-colour changing floodlighting and a white circuit. The colour lighting to be controlled by a motor-driven colour cycle dimmer.

Further details of the work and forms of tender are obtainable from the Borough Engineer and Surveyor at the undermentioned address.

The forms of tender to be returned to the undersigned sealed in the envelope provided with no mark indicating the sender by Tuesday, October 2, 1951.

D. J. OSBORNE,
Town Clerk.

Town Hall,
Leyton, E.10. (M 27)

## APPOINTMENTS VACANT

### NORTH WESTERN GAS BOARD

APPOINTMENT OF ELECTRICAL ENGINEER—BOARD HEADQUARTERS

APPLICATIONS are invited for the position of ELECTRICAL ENGINEER at the Headquarters of the Board. The commencing salary will be £1,250 per annum.

Applicants must be Corporate Members of the Institution of Electrical Engineers; a University Degree or its equivalent in Electrical Engineering will be an advantage but not a necessary qualification.

Applicants should be qualified to design and lay out schemes for the electrical power and lighting requirements of a gas works, together with detailed specifications covering such schemes. A knowledge of small generating units up to 5,000 kW is essential. It will be an added advantage if the applicant has had some experience in electronics.

The successful applicant may be required to pass a medical examination and to subscribe to such scheme of superannuation as the Board may adopt.

Applications appropriately endorsed, giving personal details, particulars of present position, training, qualifications and experience, should be addressed to the Secretary, North Western Gas Board, Bridgewater House, 60 Whitworth Street, Manchester 1, within 14 days of the publication of this advertisement. (M 29)

### BRITISH ELECTRICITY AUTHORITY

*Eastern Division*

APPLICATIONS are invited for the following appointment at the Peterborough Generating Station:

STATION SHIFT CONTROL/BOILER SHIFT CONTROL ENGINEER

The salary will be in accordance with the N.J.B. Schedule A, Grade 10, Class "E" (£488-£502) per annum. Shortly rising to Grade 10, Class "F" (£510-£530 per annum).

Applicants should have reached the standard of the Ordinary National Certificate in Electrical Engineering, or its equivalent, and have had experience in the operation of a switchboard at a generating station and be fully conversant with high tension switching operation and protective systems. Experience in the operation of pulverised fuel fired steam raising plant will be an advantage.

The successful applicant will be required to interchange the duties of station shift control engineer and boiler shift control engineer.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than September 14, 1951.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (M 30)

### LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the South Western Sub-Area Drawing Office at Wandsworth, London, S.W.18.

Candidates should have had a good general and technical education in building, construction and architecture, and experience in the design of small buildings in brickwork and reinforced concrete, and the drawing up of specifications.

Pending grading of the post under the National agreement of the appropriate negotiating body, the commencing salary will be within the range of £500-£550 per annum, inclusive, according to qualifications and experience.

Application forms, obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed, within seven days of receipt. Please enclose addressed foolscap envelope and quote ref. V/1307/T on all correspondence. (M 22)

### RAILWAY EXECUTIVE

*Mechanical and Electrical Engineering Department, London Bridge*

VACANCY FOR POWER SUPPLY ENGINEER
(Post R.241)

THE Railway Executive invite applications for the position of Power Supply Engineer, London Bridge, Southern Region, the approximate commencing salary range for which is £1,000 to £1,100 per annum, according to qualifications. The successful candidate will be eligible for membership of a Superannuation Fund scheme subject to the requirements of the Rules.

Candidates should be trained engineers with thorough technical knowledge of electric power supply and transmission; practical experience in operation and maintenance of generating plant, traction sub-stations. Good administrative ability essential. Post vacant January, 1952.

Applications, giving full particulars of education, age and experience, should be sent within 14 days to the Secretary, Railway Executive, 222 Marylebone Road, N.W.1. Any approach except by direct and written application from candidates themselves will be a disqualification. (M 35)

## UGANDA ELECTRICITY BOARD

STOREKEEPER/CLERK

THE Uganda Electricity Board invite applications to fill the appointment of Storekeeper/Clerk. Applicants should have had a sound education and practical experience in a similar capacity.

The commencing salary, to be decided according to qualifications and experience, will be within the scale £580 by £40 to £780, and a temporary allowance of 15% of salary will be payable in addition for so long as the Board may decide.

Rent free housing accommodation (partly furnished) or an allowance in lieu, free medical and dental treatment for self and family, and free passages to and from Uganda up to the equivalent of three adult passages, will be provided. First contract will be for three years with 90 days vacation leave (or 180 days if contract is renewed) at the end thereof on full salary. Local leave may also be granted up to a total of 36 days during the period of the contract. Provident and pension schemes are applicable.

Forms of application, obtainable from the Board's London Office, 129 Grand Buildings, Trafalgar Square, London W.C.2, are to be completed and addressed to the undersigned, and posted so as to reach Kampala not later than one month from the date of publication of this notice.

C. R. WESTLAKE,
Chairman.

P.O. Box 559, Kampala,
Uganda, East Africa. (L 721)

## BRITISH ELECTRICITY AUTHORITY

ASSISTANTS, CONTRACT INVOICE SECTION CHIEF ACCOUNTANT'S DEPARTMENT—HEADQUARTERS

APPLICATIONS are invited for one or two appointments as Assistants in the Contract Invoice Section of the Chief Accountant's Department at Headquarters.

The duties of the appointments will be concerned with the checking of claims and invoices in respect of civil, mechanical and electrical engineering contracts. Previous experience of the work is necessary, and applicants will be expected to have a good knowledge of the Standard Conditions of Contract and of the Working Rule Agreements applicable to at least one of the industries concerned.

The salaries for the appointments, which are superannuable, will be within Grade 2 of the National Joint Council Permanent Salary Agreement (Administrative and Clerical Grades), i.e. £420 per annum to £480 per annum, inclusive of London Allowance throughout.

Letters of application, stating age and giving details of experience, should be addressed to D. Moffat, Director of Establishments, British Electricity Authority, British Electricity House, Great Portland Street, London, W.1, to arrive not later than September 22, 1951.

Please quote reference AE/200 when replying to this advertisement. (M 2)

## LONDON ELECTRICITY BOARD

DRAUGHTSMEN

APPLICATIONS are invited for positions as Draughtsmen in the South Western Sub-Area Drawing Offices at Battersea, S.W.11, and Balham, S.W.12.

Candidates should have received a good general education and have had experience in the preparation and maintenance of cable route plans and operational diagrams. Some technical training in electrical engineering would be an advantage.

Pending grading of the posts under the National agreement of the appropriate negotiating body, the commencing salary will be within the range of £300 to £500 per annum inclusive, according to qualifications and experience.

Application forms, from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed within 10 days. Please enclose addressed foolscap envelope and quote ref: V/1308/T on all correspondence. (M 32)

## BRITISH ELECTRICITY AUTHORITY

*East Midlands Division*

CHEMIST, LINCOLN

APPLICATIONS are invited for the post of CHEMIST at St. Swithin's Generating Station, Lincoln.

Candidates should have had a good experience in modern power station laboratory work, covering analysis of fuel, water and oil, be thoroughly conversant with water softening and treatment and have some knowledge of problems relating to corrosion and boiler fouling.

Salary for this appointment will be within Grade 7, Class "F," of the N.J.B. Salary Scale.

The post will be superannuable within the terms and conditions of the B.E.A. and Area Boards' superannuation scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, Barker Gate, Nottingham, and should be returned not later than September 14, 1951.

L. F. JEFFREY,
Divisional Controller.
(L 763)

## BRITISH ELECTRICITY AUTHORITY

*North Eastern Division*

APPOINTMENT OF JUNIOR ENGINEER, ELECTRICAL MEASUREMENTS SECTION, TECHNICAL DEPARTMENT, DARLINGTON

APPLICATIONS are invited for the position of JUNIOR ENGINEER in the electrical measurements section of the technical department at Darlington.

The successful candidate's work will be chiefly concerned with the maintenance of instruments and meters, and experience in this class of work is essential. Technical education should be of at least National Certificate Standard and works training will be an advantage.

The salary will be in accordance with Grade 9, Schedule "C" of the National Joint Board Agreement (£375-£536 per annum) and commence at a point commensurate with qualifications and experience.

Superannuation will be in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Forms of application may be obtained from the Divisional Secretary (Establishments), British Electricity Authority, North Eastern Division, Carliol House, Newcastle-upon-Tyne, 1, to whom they should be returned to arrive not later than September 24, 1951. (L 765)

## BRITISH ELECTRICITY AUTHORITY

*East Midlands Division*

GENERAL ASSISTANT ENGINEER, ELECTRICAL MEASUREMENT SECTION, TECHNICAL DEPARTMENT

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the Technical Department. Candidates should have a knowledge of power metering and experience in a polyphase testing station. The possession of a Higher National Certificate in electrical engineering is desirable.

The salary for this appointment will be in accordance with Grade 8, Schedule C of the National Joint Board Agreement, Class "AX/DX," £437 to £522 per annum, according to qualifications and experience.

The successful candidate will be required to reside in or near Loughborough.

Superannuation will be in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and should be delivered to the undersigned not later than September 14, 1951.

L. F. JEFFREY,
Divisional Controller.

August 20, 1951. (L 764)

## LONDON ELECTRICITY BOARD

SUB-AREA METER ENGINEER

APPLICATIONS are invited for the above position in the Engineering Department of the South Eastern Sub-Area, from engineers who should be Corporate members of the I.E.E.

Applicants should have an intimate technical knowledge of electricity meters and ancillary apparatus, and have had experience of testing and repairing meters on a large scale. The successful applicant will be responsible to the Sub-Area Meter and Test Superintendent for the efficient running and organisation of the Meter Section, which is based at Erith, Kent.

The post is graded under Schedule A of the National Joint Board Agreement (February 17, 1950) as Class "G," Grade 7, £683 11s. per annum, rising to £712 19s. per annum, inclusive of London Area Allowance. The classification shown is that applicable to last year (1950-51) and any revision of classification for the current year, arising when the figures for the whole Area are available, will be applied to this post retrospectively.

Application forms obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed within seven days of receipt. Please enclose addressed foolscap envelope and quote ref. V/1309/T on all correspondence. (M 1)

## LONDON ELECTRICITY BOARD

FITTERS (ELECTRICAL)

APPLICATIONS are invited for positions as Fitters (Electrical) in Whitechapel/Stepney, E.1, West Hampstead, N.W.3, Ilford, Essex, Leytonstone, E.11, Walthamstow, E.17, and western districts of London.

Rates of pay and conditions of employment in accordance with the agreement of National Joint Industrial Council for the Electricity Supply Industry, i.e. 3s. 4½d. per hour which amounts to £7 8s. 6d. per 44-hour, 5-day week.

Application forms obtainable from Establishments Officer, 46 New Broad Street, E.C.2. Please enclose addressed envelope and quote ref: M/F/T on all correspondence. (M 31)

## NORTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

### *No. 1 Sub-Area*

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER—CENTRAL DISTRICT

The person appointed will be required to assist in organising and controlling all commercial work and the necessary staff in the District, and will be under the guidance of the District Commercial Engineer for furthering the Board's development and sales policy.

The duties will include:

1. Supply of information and advice to all classes of consumers on electricity utilisation tariffs, and on all matters concerning electricity service.

2. Control of showrooms, demonstrations, exhibitions and publicity.

3. Organisation and supervision of consumer records.

If an applicant has specialised knowledge in any particular aspect of development (domestic, commercial or industrial), details should be given.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "G," Grade 7, i.e. £651 to £665 to £679 per annum.

Applications, stating age, qualifications and experience, present post and salary, should be received by the Sub-Area Secretary, No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester 2, P.O. Box 493, not later than Saturday, September 15, 1951.

### *No. 3 Sub-Area*

JUNIOR ENGINEER (TESTING ASSISTANT)

Applications are invited for the appointment of a Junior Engineer (Testing Assistant) in the Testing Section of the No. 3 Sub-Area Technical Engineer's Department at Stalybridge.

Applicants should have had experience of field testing work such as commissioning and testing of protective gear. The duties will include the testing of transformers and switchgear, pressure testing and testing work in connection with technical investigations, and maintenance of supervisory and control schemes. Experience in any of these duties will be considered an advantage. Technical education to Higher National Certificate standard is desirable.

The salary for the post, which is superannuable, will be in accordance with the National Joint Board Schedule and within the range Class "K," Grades 19-15, i.e. £375 to £478 per annum.

Applications, stating age, education, training, present post and salary, technical qualifications and experience, should be received by E. Binns, Esq., M.I.Mech.E. A.M.I.E.E., Sub-Area Manager, No. 3 Sub-Area Headquarters, North Western Electricity Board, Union Street, Oldham, not later than Saturday, September 15, 1951.

### *No. 6 Sub-Area*

THIRD ASSISTANT ENGINEERS, SUB-AREA HEADQUARTERS

Applications are invited for the following appointments in the Mains Department at No. 6 Sub-Area Headquarters, Castle Green, Kendal:—

(a) TWO THIRD ASSISTANT ENGINEERS (Operation and Maintenance)

The duties are primarily concerned with assisting in compiling and maintaining records covering system loadings and operations, operation diagrams, plant and machinery maintenance, fault records, etc.

Applicants should have field experience in h.v. and l.v. distribution systems and have attained a reasonable standard of technical education.

(b) TWO THIRD ASSISTANT ENGINEERS (Planning and Construction)

Applicants should have had a sound technical training and be capable of the preparation of schemes and estimates for h.v. and l.v. networks and substations up to 11 kV. A knowledge and experience of cable-laying and overhead line construction, scheduling of materials and the preparation of notices, is required.

Qualifications leading to Corporate Membership of the Institution of Electrical Engineers will be an advantage.

The salaries for these posts will be in accordance with the National Joint Board Revised Schedule, Class "H," Grade 10, i.e. £571 to £584 to £597 per annum.

GENERAL ASSISTANT DISTRICT ENGINEER—Workington District

The duties will be to assist senior engineers in the construction, operation and maintenance of overhead and underground mains and sub-station plant. Drawing Office experience and ability to make sketches in the field from which records can be taken would be an advantage.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "E," Grade 11, i.e. £459 to £467 to £475 per annum.

Applications for the above posts, stating age, experience, qualifications, present post and salary, should be received by the Sub-Area Manager, No. 6 (Lakeland) Sub-Area, North Western Electricity Board, Castle Green, Kendal, not later than Saturday, September 15, 1951.

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### *No. 7 Sub-Area*

THIRD ASSISTANT ENGINEER (ASSISTANT TO THE STATISTICAL ENGINEER)

Applications are invited for the appointment of Third Assistant Engineer in the Statistical Section of the Technical Engineer's Department at No. 7 Sub-Area Headquarters, Chapel Street, Hazel Grove.

Applicants should have a good knowledge of distribution practice and preference will be given to those who hold the Higher National Certificate in Electrical Engineering or an equivalent qualification.

The duties will include the collection and analysis of technical data relating to an extensive underground and overhead distribution system.

The salary for the post will be in accordance with the National Joint Board Revised Agreement, Class "G," Grade 10, i.e. £539 to £550 to £561 per annum.

Applications, stating age, education and training, qualifications and experience, present post and salary, should be received by the Sub-Area Manager, No. 7 Sub-Area, North Western Electricity Board, Chapel Street, Hazel Grove, Cheshire, not later than Saturday, September 15, 1951. (M 33)

## BRITISH ELECTRICITY AUTHORITY

### *Eastern Division*

APPLICATIONS are invited for the following appointment:

SHIFT CHARGE ENGINEER—NORWICH GENERATING STATION

Salary in accordance with the N.J.B. Schedule "A," Grade 7, Class "F," (£625-£643 per annum).

Applicants should have served an apprenticeship and obtained a Higher National Certificate in electrical and/or mechanical engineering or equivalent and possess experience in the operation of B.T.H. and Parsons turbines at generating stations. Experience with steam plant operating at 675 P.S.I. will be an advantage.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London N.14, to arrive not later than September 14, 1951. Envelopes should be endorsed "Shift Charge Engineer—Norwich."

W. N. C. CLINCH,
Controller.

Northmet House, Southgate,
London N.14. (L 747)

## BRITISH ELECTRICITY AUTHORITY

### *Midlands Division*

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER (Civil) in the Transmission Department at Divisional Headquarters. Salary will be in accordance with Schedule C, Class "AX/DX," Grade 5 of the National Joint Board Agreement, £579 to £776 per annum.

Applicants for this appointment should have received theoretical and practical training in civil engineering and have passed Parts A and B of the Examination for Associate Membership of the Institution of Civil Engineers, or hold qualifications exempting therefrom, and should have had experience in the design, setting out and supervision of siteworks, foundations, buildings and reinforced concrete structures. They should be accustomed to dealing with specifications, bills of quantities, drawings and correspondence relating to such works.

Conditions of service will be in accordance with the National Joint Board Agreement and superannuation under terms approved by the British Electricity Authority.

Forms of application may be obtained from the Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned not later than September 23, 1951. (M 36)

## NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the post of an ASSISTANT ENGINEER (Telecommunications) at the Board's Head Office in Edinburgh.

Candidates should have a knowledge of the planning and design of Remote Supervisory and Direct Wire Control Equipments, Remote Metering and Indicating Equipments, Carrier, Telephone and Telegraph Transmission Equipments, and have actual operating experience with one or more of such equipments. The possession of a University Degree or equivalent, and Corporate Membership of the I.E.E. will be an advantage.

The salary is in accordance with the N.J.B. Agreement, Grade 2, Schedule C, Class "AX," commencing £752 per annum, and the post will be superannuable.

Applications (on Form to be obtained from the Secretary, North of Scotland Hydro-Electric Board, 16 Rothesay Terrace, Edinburgh 3), should be submitted not later than two weeks from the appearance of this advertisement. (L 782)

## BRITISH ELECTRICITY AUTHORITY

*London Division*

APPLICATIONS are invited for the following appointments at Fulham Generating Station:

STATION SHIFT CONTROL ENGINEER

Applicants should possess good technical qualifications up to Higher National Certificate standard, or its equivalent, and have had a sound technical training and practical experience in the control and operation of steam generating plant and main switchgear in a modern power station.

Salary and conditions of service in accordance with N.J.B. Schedule, Class "K," Grade 10, plus London Allowance = £678 6s. per annum.

ASSISTANT ENGINEER (Electrical Testing)

Applicants should have had an engineering apprenticeship followed by experience of electrical testing, preferably in a modern power station.

Technical education to the Higher National Certificate standard of above will be an advantage.

Salary and conditions of service in accordance with N.J.B. Schedule, Class "K," Grade 12, plus London Allowance = £590 2s. per annum.

The foregoing posts are superannuable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(M 5)

## NEWCASTLE-UPON-TYNE EDUCATION COMMITTEE

RUTHERFORD COLLEGE OF TECHNOLOGY

*Principal:* H. A. SCARBOROUGH, M.A., D.Sc.

APPLICATIONS are invited for appointment as ASSISTANT LECTURER in Electrical Engineering. Candidates should have appropriate academic qualifications and industrial experience, and be prepared to teach elementary electrical engineering and ancillary engineering subjects.

Salary initially as Assistant, Grade A (£375 by £18 to £630, with additions or allowance for qualifications, training and experience in industry).

Application form and conditions of appointment may be obtained from the undersigned, to whom completed applications should be sent within 14 days of the appearance of this advertisement.

H. V. LIGHTFOOT,
Director of Education.

City Education Office,
Northumberland Road,
Newcastle-upon-Tyne, 1. (M 15)

## BRITISH ELECTRICITY AUTHORITY

*South Eastern Division*

STATION SHIFT CONTROL ENGINEER at Tunbridge Wells Power Station. Applicants should have had experience in Control Room duties, and have had suitable technical training. Class "C," Grade 10, £438 per annum.

ASSISTANT SHIFT CHARGE ENGINEER at Littlebrook. Applicants should have technical qualifications equivalent to Graduate Membership of either the Institute of Mechanical or Electrical Engineers and should have had responsible experience of the operation of modern high pressure power station plant. A good knowledge of the efficient operation of boiler and turbine plant is essential. Preference will be given to those with P.F. experience. Class "J," Grade 9, £678 6s. per annum including London Allowance.

N.J.B. Conditions of Service for both positions. Applications on forms obtainable from Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-upon-Thames, to be returned by September 12, 1951. (M 26)

## SUDAN GOVERNMENT

THE Equatoria Projects Board have a vacancy for a young MECHANICAL ENGINEER with a thorough practical engineering training and a wish to learn and widen his experience. Ordinary National Certificate or equivalent technical qualifications required.

Age limit about 27.

Two years contract. Salary up to £E.648 according to age, with a post service gratuity of two months' salary and three and a half months' leave on full pay. A cost of living allowance varying between £E.142 for a single man and £E.352 for a married man with dependants, is at present payable. £E.40 outfit allowance payable on first appointment. There is at present no income tax in the Sudan.

Further particulars and application form may be obtained, on written application, from The Sudan Agent in London, Wellington House, Buckingham Gate, London, S.W.1.

Please mark envelopes "Engineer E.P.B. 4/2301." (M 17)

## BRITISH ELECTRICITY AUTHORITY

*Eastern Division*

APPLICATIONS are invited for the following appointment:

PRINCIPAL ASSISTANT (Divisional Secretary's Department)

The salary will be in accordance with Grade 9 of the National Joint Council's Salary Agreement (£900-£1,020 per annum, plus London Weighting).

Applicants should have had wide administrative experience and the person appointed will be responsible for the Section of the Divisional Secretary's Department dealing with General Administrative Work.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications, stating age, qualifications, present position and salary, should be sent to the Divisional Secretary, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than September 14, 1951.

Envelopes should be endorsed "Principal Assistant."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, N.14. (M 19)

## SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of ASSISTANT in the Commercial Department of District 226 (Llanelly) in the West Central Sub-Area of the Board.

Applicants must have had a sound engineering training and will be required to deal mainly with installation and contracts.

The salary for the position will be in accordance with Class "E," Grade 12 (£420 to £428 to £436) of the National Joint Board Schedule for the Electricity Supply Industry.

Applications, stating age, present position, present salary, qualifications and experience and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments), South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than September 15, 1951.

D. G. DODDS,
Secretary.
(M 34)

## MIDLANDS ELECTRICITY BOARD

*Wolverhampton and District Sub-Area*

APPOINTMENT OF FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for the above post in the Lichfield District of the Wolverhampton and District Sub-Area.

Applicants should have had a sound technical training with practical experience of industrial, domestic and rural load development and in particular contracting work, including maintenance and consumer service.

Appropriate technical qualifications will be considered an advantage.

The appointment will be in accordance with N.J.B. conditions, and the salary will be Class "D," Grade 6, £594-£616 per annum.

Applications, stating age, experience, qualifications and present salary, should be forwarded within seven days to Mr. F. J. Elliott, Sub-Area Manager, Wolverhampton and District Sub-Area, Midlands Electricity Board, 83 Darlington Street, Wolverhampton.

A. STEPHENS,
Secretary.
(M 3)

## SUDAN GOVERNMENT

THE Equatoria Projects Board require a MECHANICAL ENGINEER having a practical knowledge of l.t. alternating current generation and distribution. Must have had a practical mechanical engineering training with subsequent experience with the running and maintenance of oil and gas engines. Higher National Certificate or equivalent technical qualifications required.

Age about 35.

Two years contract. Salary up to £E.948 according to age with a post service gratuity of two months' salary and three and a half months' leave on full pay. A cost of living allowance, varying between £E.142 for a single man and £E.352 for a married man with dependants, is at present payable. £E.60 outfit allowance payable on appointment. There is at present no income tax in the Sudan.

Further particulars and application form may be obtained on written application from the Sudan Agent in London, Wellington House, Buckingham Gate, London, S.W.1.

Please mark envelopes "Mech.Elect.Engineer E.P.B. 4/2301." (M 16)

## BRITISH ELECTRICITY AUTHORITY

*South Wales Division*

APPLICATIONS are invited for the following appointments at salaries in accordance with the revised National Joint Board Agreement:—

(a) STATION CHEMIST, Cardiff (Roath) Power Station, Class "F", Grade 7 (£625–£643 per annum).

(b) GENERAL ASSISTANT ENGINEER, Technical Department, Divisional Headquarters, Class "AX/CX," Grade 8 (£437–£604 per annum).

Applicants for (a) should preferably possess a B.Sc. degree, be Associate Members of the Royal Institute of Chemistry, or have obtained an equivalent qualification, whereas applicants for (b) should preferably possess a B.Sc. degree or the Higher National Certificate (Electrical).

Candidates for (a) should also have had sound experience in water treatment chemistry and coal and oil testing. Previous experience in a manufacturing works in the testing and commissioning of electrical equipment including protective gear would be considered an advantage for appointment (b).

The appointments will be superannuable under the British Electricity Authority and Area Boards Scheme.

Forms of application may be obtained from the Divisional Secretary at the address below to whom completed applications should be returned not later than September 18, 1951.

H. V. PUGH,
Divisional Controller.

British Electricity Authority,
Cardiff (Pengam Moors) Airport,
Cardiff. (M 38)

## BRITISH ELECTRICITY AUTHORITY

*London Division*

APPLICATIONS are invited for the following appointments at Brunswick Wharf Generating Station:

ASSISTANT MAINTENANCE ENGINEER (Electrical)

Candidates should have had extensive electrical maintenance experience, preferably at a power station, and should possess the Higher National Certificate or its equivalent. An apprenticeship with a reputable engineering manufacturer would be an added advantage.

Salary and conditions of service in accordance with N.J.B. Schedule, Class "G" (based on first section), Grade 9, i.e. £599 11s. per annum, inclusive of London Allowance.

STATION SHIFT CONTROL ENGINEERS

Candidates should have had a good general education, and technical training up to Higher National Certificate standard is preferred.

Previous experience in the operation and control of E.H.T. switchgear is essential.

Salary and conditions of service in accordance with N.J.B. Schedule, Class "G" (based on first section), Grade 10, i.e. £565 19s. per annum, inclusive of London Allowance.

The foregoing posts are superannuable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE
Divisional Controller.
(M 6)

## LONDON ELECTRICITY BOARD

SUB-AREA SECTION ENGINEER (CONSTRUCTION)

APPLICATIONS are invited for the above position in the Engineering Department of the South Eastern Sub-Area at Woolwich, S.E.18.

Applicants should be engineers who are Corporate Members of the I.E.E., and have a sound technical education and also have had considerable practical experience in electricity distribution, particularly of underground cable systems, both h.v. and m.v., in heavy industrial and residential areas. In addition to having the necessary technical and practical knowledge of construction work they should also possess the necessary administrative ability and knowledge of the working conditions and rates applicable in the electricity supply industry.

The post is graded under Schedule "A" of the National Joint Board Agreement (February 17, 1950) as Class "G," Grade 4, £862 1s. per annum, rising to £901 19s. per annum inclusive of London Area Allowance. The classification shown is that applicable to last year (1950/1951), and any revision of classification for the Sub-Area for the current year, arising when the figures for the whole Area are available, will be applied to this post retrospectively.

Application forms, obtainable from Establishments Officer, 46 New Broad Street, E.C.2, to be returned, duly completed, within seven days of receipt. Please enclose addressed foolscap envelope and quote Ref. V/1310/T. on all correspondence. (M 59)

## LONDON ELECTRICITY BOARD

TECHNICAL ASSISTANT IN THE SUB-AREA DESIGN AND PLANNING BRANCH

APPLICATIONS are invited for the above position in the Engineering Department of the North Eastern Sub-Area at Stratford, E.15.

Applicants should possess a Degree in Electrical Engineering or have equivalent qualifications, and have a wide experience in the design and layout of large underground distribution systems at pressures up to and including 11 kV, in heavy industrial and residential areas. A knowledge of the application of modern protective equipment, calculation of fault levels and the preparation of load flow diagrams would be an advantage.

The post is graded under Schedule A of the National Joint Board Agreement (February 17, 1950) as Second Assistant Engineer, Class "K," Grade 7, £825 6s. per annum, rising to £863 2s. per annum, inclusive of London Area Allowance.

Application forms from Establishments Officer, 46 New Broad Street, E.C.2, to be returned duly completed within seven days of receipt. Please enclose addressed foolscap envelope and quote ref. V/1302/T on all correspondence. (M 11)

## BRITISH ELECTRICITY AUTHORITY

*East Midlands Division*

SHIFT CONTROL ENGINEER, SPONDON

APPLICATIONS are invited for the position of Shift Control Engineer at Spondon Generating Station.

Applicants should have had a sound training and practical experience in a modern generating station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be advantageous.

The salary will be in accordance with Class "H," Grade 10 of the National Joint Board Schedule and the post will be superannuable under the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, and should be delivered to the undersigned not later than September 17, 1951.

L. F. JEFFREY,
Divisional Controller.
(M 13)

## BRITISH ELECTRICITY AUTHORITY

*London Division*

SHIFT CHARGE ENGINEER—TAYLORS LANE GENERATING STATION

APPLICATIONS are invited for the above appointment.

Candidates should have technical qualifications up to Higher National Certificate standard, including thermodynamics as a subject, together with a good general education. Considerable experience in the operation of a modern power station is essential and must include experience on modern high pressure plant, and of switchgear connected with a large distribution system. Character and ability to deal with staff problems is important.

Salary and conditions of employment in accordance with N.J.B. Schedule, Class "F," Grade 7, i.e. £656 5s. per annum inclusive of London allowance.

The post is pensionable.

Applications, stating age, qualifications and experience, should be addressed to the Divisional Secretary, British Electricity Authority, London Division, Ergon House, Horseferry Road, Westminster, S.W.1, to be received within 14 days of the appearance of this advertisement.

J. N. WAITE,
Divisional Controller.
(M 50)

## BRITISH ELECTRICITY AUTHORITY

*East Midlands Division*

DEPUTY STATION SUPERINTENDENT, BURTON

APPLICATIONS are invited from suitably qualified engineers for the post of Deputy Station Superintendent at Wetmore Road Generating Station, Burton-on-Trent.

Salary for the post will be within Class "E," Grade 3 (£775 to £809 per annum) within Schedule "A" of the N.J.B. Agreement.

The post will be superannuable within the terms and conditions of the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, British Electricity House, Barker Gate, Nottingham, and should be returned not later than September 24, 1951.

L. F. JEFFREY,
Divisional Controller.
(M 49)

## YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

### *No. 3 (Sheffield) Sub-Area*

ENGINEERING DRAUGHTSMAN (Vacancy No. 111/51)

Applicants must have a good general education and preferably a practical training. They should be experienced in the compiling of mains records. The duties will include taking instrumental surveys for building and other civil engineering works and for routes and contours for mains extensions or alterations.

Salary, N.J.B. Agreement Class "D," Grade 6, £375 to £500 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, within fourteen days of the appearance of this advertisement.

### *No. 5 (Wakefield) Sub-Area*

GENERAL ASSISTANT ENGINEER (CONSTRUCTION) (Vacancy No. 111/51)

Applicants must have had a sound practical training and experience in the construction, operation and maintenance of h.v. and l.v. overhead and underground distribution networks, substation plant and ancillary equipment.

Salary, N.J.B. Agreement Class "J," Grade 13, £486 to £506 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, within fourteen days of the appearance of this advertisement.

### *No. 6 (Hull) Sub-Area*

SECOND ASSISTANT DISTRICT ENGINEER (BRIDLINGTON) (Vacancy No. 103/51)

Applicants should have had sound practical experience in the operation, maintenance, planning and construction of h.v. and l.v. underground and overhead lines and substations in an extensive rural area.

Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. The successful candidate would be required to undertake standby duty and to reside in Driffield.

Salary, N.J.B. Agreement Class "D," Grade 7, £563 to £573 per annum.

Applications, stating the above vacancy number, and giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, within fourteen days of the appearance of this advertisement. (M 44)

## SOUTH LANCASHIRE TRANSPORT COMPANY

SHIFT CHARGE ENGINEER (ATHERTON GENERATING STATION)

APPLICATIONS are invited for the above appointment. The applicant will be required to take entire charge of shift in a generating station having 5,000 kW alternator, Babcock and Wilcox boilers and all auxiliary plant. He will have to carry out all E.H.T. switching operations and load control on generating plant running in parallel with and supplying the British Electricity Authority's transmission system. Applicant must have had previous experience of boiler plant operation, and control of staff required for the same.

The salary and conditions of service will be in accordance with the N.J.B. Schedule of Salaries and conditions for staff members of the electricity supply industry, Schedule A, Class "B," Grade 7, at present £492.

The selected candidate must pass a medical examination by the Company's medical adviser, and reside within the adjacent district.

Applications, stating age, particulars of training, experience and copy of recent testimonials, must reach the undersigned not later than Wednesday, September 19, 1951.—E. H. Edwardes, A.M.I.E.E., Engineer and Managing Director, South Lancashire Transport Company, Head Office, Atherton, Lancs. (M 48)

## BRITISH ELECTRICITY AUTHORITY

### *South Eastern Division*

JUNIOR CHEMIST, AT KINGSTON 'B' POWER STATION

APPLICANTS should have had experience in analysis and testing of coal, oil and water, and should preferably have received a technical education up to Inter B.Sc. standard.

N.J.B. conditions of service and salary, Class "G," Grade 16/14, commencing at £400 per annum including London allowance.

Applications, on forms obtainable from the Divisional Secretary, B.E.A., S.E. Division, Lower Ham Road, Kingston-upon-Thames, to be received by September 22, 1951. (M 46)

## BRITISH ELECTRICITY AUTHORITY

### *Eastern Division*

TECHNICAL STAFF

APPLICATIONS are invited for the following appointments:—

(a) JUNIOR ENGINEERS—Little Barford Generating Station.

(b) JUNIOR ENGINEERS—Peterborough Generating Station.

Salaries in accordance with Clause 35 of the N.J.B. Schedule "A," as follows:—

(a) Class "G," Grade 16, £375 to Grade 14, £428 per annum.

(b) Class "E," Grade 14, £375 to Grade 14, £387 per annum.

For appointment (b) additional plant will shortly increase the class to "F," £392 to £405 per annum.

Preference will be given to applicants who have had previous experience in a generating station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

The appointments will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London N.14, to arrive not later than September 14, 1951. Envelopes should be endorsed with the appointment sought.

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, London N.14. (M 39)

## BRITISH ELECTRICITY AUTHORITY

### *Southern Division*

APPLICATIONS are invited for the following positions in the Technical and System Operation Liaison Departments:—

(a) THIRD ASSISTANT ENGINEERS, "AX/BX" 5, £579 to £731.

(b) GENERAL ASSISTANT ENGINEERS, "AX/BX," 8, £437 to £586.

Applicants should have received a sound technical education and preference will be given to candidates who are corporate members of a senior professional engineering institution or hold qualifications leading to corporate membership.

For appointment (a), one post will deal particularly with special experimental investigations into technical problems. Two engineers are required with experience in the operation and control of inter-connected power systems and/or in the operation of power station plant. A knowledge of the preparation of operational statistics and graphical presentation will be an advantage.

The General Assistant Engineers are required more particularly in the Technical Department.

Application forms may be obtained from the undersigned and should be returned not later than Friday, September 21, 1951.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
111 High Street,
Portsmouth. (M 54)

## EASTERN ELECTRICITY BOARD

### *Suffolk Sub-Area*

SECOND ASSISTANT ENGINEER (OPERATION AND MAINTENANCE)

APPLICATIONS are invited for the appointment of a Second Assistant Engineer on the establishment of the Sub-Area Engineer at Woodlands Substation, Badley, Stowmarket.

Candidates should have had sound technical training and experience in the construction, operation and maintenance of substations and overhead and underground systems up to and including 33 kV in a predominantly rural area. Experience of system control in a large rural area is essential. Corporate membership of the Institution of Electrical Engineers or equivalent qualifications will be an advantage.

The salary for the appointment will be in accordance with Class "H," Grade 7 of the National Joint Board Salary Agreement, commencing at £692 per annum. Both future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a Superannuation Scheme and may be required to undergo a medical examination.

Applications, stating age, education, technical qualifications and experience, with details of present appointment and salary, should be submitted to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk, within 14 days of the appearance of this advertisement. (M 53)

## BRITISH ELECTRICITY AUTHORITY

*Eastern Division*

APPLICATIONS are invited for the following appointments:—

STATION SHIFT CONTROL ENGINEER—Ipswich Generating Station.

Salary in accordance with the N.J.B. Schedule "A," Grade 10, Class "D" (£465-£481 per annum).

Applicants should have reached the standard of Ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a switchboard at a generating station and be fully conversant with high tension switching operations and protective systems.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London N.14, to arrive not later than September 14, 1951. Envelopes should be endorsed "Station Shift Control Engineer—Ipswich."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, London N.14. (M 41)

## MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of SENIOR ASSISTANT ENGINEER (Planning and Operation) in the department of the Board's No. 1 Sub-Area Engineer, 24 Hatton Garden, Liverpool, 3, at a salary in accordance with N.J.B. Grade I.4 (£1,075 to £1,125).

Applicants should be Chartered Electrical Engineers with good technical qualifications and should have experience of the design, construction and operation of distribution systems, and knowledge of the technical and economic factors involved in system layout and design. Experience in the preparation of complete distribution schemes and estimates is desirable. The successful candidate will be required to undertake work on his own responsibility.

The appointment will be superannuable and subject to medical examination.

Applications, on forms obtainable from the Manager, Ref. 6A, No. 1 Sub-Area, at the above address, should be submitted not later than September 17, 1951.

JAMES RANKIN,
Secretary.
(M 47)

## BRITISH ELECTRICITY AUTHORITY

*Eastern Division*

TECHNICAL STAFF

APPLICATIONS are invited for the following appointment:—

STATION CHEMIST—PETERBOROUGH GENERATING STATION

Salary will be in accordance with the N.J.B. Agreement, Schedule "A," Class "E," Grade 7 (£579-£609 per annum). Reconstruction will extend the station classification to Class "F" (£625-£643) later this year.

Applicants should have scientific education to B.Sc. or A.R.I.C. standard and must be familiar with the sampling and analysis of fuel, oil and water. They should also have experience in control of boiler feed-water treatment and in the analysis of deposits.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' superannuation scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London N.14, to arrive not later than September 14, 1951. Envelopes should be endorsed "Station Chemist—Peterborough."

W. N. C. CLINCH,
Controller.

Northmet House,
Southgate, London N.14. (M 40)

A LARGE manufacturing Company in the Midlands require a CONTRACT ENGINEER with some technical training and commercial experience to handle orders for medium size motors and alternators.—Please apply, giving full details of age, experience, and salary required, to Box No. 1003, Electrical Times. (M 23)

**BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2**

## DRAUGHTSMEN

Vacancies exist for experienced electrical and mechanical draughtsmen in switchgear engineering. Permanency and good prospects for suitable applicants. Five-day week, canteen services, superannuation.—Written applications, stating full details age, experience and qualifications to:

**The Personnel Manager, A. Reyrolle and Company, Ltd., Hebburn, Co. Durham.** (M 66p)

APPLICATIONS are invited by the English Electric Co. Ltd. for vacancies for ENGINEERS to deal with all orders taken by the company for steel works installations and other metal industries projects. These comprehensive orders cover the whole field of electrical equipment, supply switchgear, rectifiers, rotating machinery, control gear and electronic apparatus. Applicants should be young men who have served a recognised relevant apprenticeship, and who have at least Higher National Certificate. The positions are permanent and progressive, and afford excellent opportunities.—Please write, giving full details and quoting Ref. 489A, to Central Personnel Services, English Electric Co. Ltd., 24-30 Gillingham Street, London S.W.1. (L 786)

BRITISH INSULATED CALLENDER'S CONSTRUCTION CO., LTD. SURVEYORS, with experience in survey work in connection with overhead transmission line construction, required for one tour in Nigeria. Salary £1,175 to £1,750 per annum according to qualifications and experience. Selected candidates will be provided with free living accommodation, and on completion of tour will be considered for positions on the home staff of the company.—Apply, in writing, giving particulars of age, experience and qualifications, together with references, to the Construction Engineer, The Old Rectory, Clay Coton, near Rugby. (L 710)

DRAUGHTSMAN, having works training and experience of switchboard and/or transformers, required for special product work of great interest. Ordinary National Certificate preferred. Working conditions admirable. Salary according to age and experience.—Box No. 1001, Electrical Times. (M 21)

DRAUGHTSMAN required for work on small electrical and thermal accessories for mass production. An interesting post for a person with enterprise and initiative. West London area.—Box No. 9085, Electrical Times. (L 703)

DRAUGHTSMEN required for contracts section, experienced on flat back and cubicle type switchgear and able to do diagrams. Good salary offered for suitably qualified applicant. Pension scheme available.—Reply, stating age, salary and full details of technical qualifications and experience, to Erskine, Heap and Co. Ltd., Lancashire Switchgear Works, Salford, Manchester 7. (L 673)

ELECTRICAL ENGINEER required by British Insulated Callender's Cables Ltd., for the technical development of electro static capacitors at their Helsby Works. Permanent position with superannuation and bonus schemes after twelve months' probationary service.—Applications, giving details of qualifications and experience, should be made in writing to the Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (M 43)

FERRANTI LTD., Hollinwood Works, Manchester, have staff vacancies in their Power Engineering Department for SENIOR ELECTRICAL AND MECHANICAL ENGINEERS, for design, development and research work on power transformers of all sizes up to 500,000 volts and 250,000 kVA including all associate apparatus such as automatic voltage regulation and thermal control. The work includes the study of thermal, electro-magnetic and constructional problems and their application in design. Engineers are required with academic qualifications and preferably subsequent engineering experience. The vacancies are for permanent appointments leading progressively to the highest positions and carry a generous salary with pension. Housing assistance may be given in special cases.—Application forms from Mr. H. J. Hebbert, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference TSE. TME. (L 613)

ENGINEERS, SURVEYORS and PROFILERS experienced in the design and construction of overhead wood pole lines required for Scottish Head Office. Good prospects and superannuation.—Apply, giving full details of experience and qualifications and salary required, all in confidence, to Box No. 1007, Electrical Times. (M 25)

FLUORESCENT lighting equipment manufacturers require REPRESENTATIVES in the Midlands and North to call on wholesalers and electrical contractors. —Those with experience in this particular field of produce and who require a change are invited to write personally to the Managing Director, H. W. Field and Son, Ltd., Harold Wood, Essex. Please write in strictest confidence giving age, full details of experience and territory preferred. Can be interviewed in home town. (M 62)

HANDLEY PAGE LTD. require an ELECTRICAL TECHNICIAN, preferably with H.N.C. (Elect.) and with a knowledge of electronics, for work in connection with the development of aircraft electrical circuits and installations.—Write, stating age, qualifications and details of experience, to Staff Officer, Handley Page Ltd., Cricklewood, London N.W.2. (L 566)

MERZ AND McLELLAN require ELECTRICAL AND MECHANICAL DRAUGHTSMEN for their Esher Office. Applicants should have layout experience preferably connected with steam power station work. Salary dependent on qualifications and experience. Pension Scheme. Canteen facilities.—Apply, stating age and full details of experience, to Milburn, Esher, Surrey. (L 740)

METER TESTER. Wages and conditions of employment in accordance with the National Joint Industrial Council Agreement.—Applications to Sub-Area Manager, South Western Electricity Board, The Parade, Taunton. (M 65)

SALES REPRESENTATIVE required by leading firm of electrical engineers for a Northern area, preferably with knowledge of the lamp and lighting industry. Excellent prospects for a keen, energetic man aged 25 to 35. Commencing salary £500 per annum. Replies treated in confidence. This is a real opportunity for a live wire with ideas and able to create new business.—Apply, Box No. 1015, Electrical Times. (M 56)

SENIOR DRAUGHTSMAN urgently required for design and lay-out of automatic electrical control gear. Interesting work on high priority defence and export projects. Good pay, canteen facilities, and three-bedroomed, unfurnished self-contained flat available for successful applicant in near future.—Apply, in strictest confidence, to the Electro Dynamic Construction Co., Ltd., Control Gear Division, Bristol Road, Bridgwater, Somerset. (M 8)

SENIOR ELECTRICAL DRAUGHTSMEN required by British firm with modern London office. Preferably with experience of power distribution and lighting installations as applied to oil refinery and chemical plants. Qualifications to H.N.C. standard. Good conditions of service, canteen facilities, pension scheme.—Write, stating age, qualifications and experience, to Box 5146, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (L 680)

SITE ENGINEERS and FOREMAN required for overhead wood pole line work in Scotland. Long term contract, good prospects, and superannuation.—Apply, giving full details of experience, qualifications and salary required, to Box No. 1005, Electrical Times. (M 24)

SWITCHGEAR DRAUGHTSMAN required with experience in domestic accessories, by light engineering company in S.W. Durham area. Good salary for suitable applicant.—Write, stating age, experience and qualifications, to Box No. 1013, Electrical Times. (M 52)

THE STEEL COMPANY OF WALES LIMITED require an experienced ELECTRICAL ENGINEER to be fully responsible for the operation and maintenance of the electrical equipment at the Cold Reduction Tinplate Plant, Trostre, Llanelly. Experience must have included supervising maintenance of e.h.t. sub-station equipment, large M.G. sets and intricate control schemes for plant drives. Applicants preferably should have been trained in the works of well known electrical manufacturers and should hold Corporate Membership of the I.E.E. or comparable qualification.—Applications, giving age, full details of experience and date available, to be addressed to the General Manager, The Steel Company of Wales Limited, Tinplate Division Office, Swansea. (M 64)

TRANSFORMER DESIGNER wanted by well-known electrical engineering company for work in a modern Liverpool factory. Applicants must have experience of distribution transformers up to 1,000 kVA. Excellent working conditions. Five-day week. First-class canteen. Wide range of sports and social activities. Pension scheme in operation after qualifying period.—Write, stating present occupation, giving full particulars of experience and mentioning ref. GBE, to Box No. 9107, Electrical Times. (L 768)

TECHNICAL LABORATORY ASSISTANTS with experience in the fields of radio and electronics are required for work in the Stanmore area.—Apply in writing, giving full details of age, qualifications and experience, to the Staff Manager (Ref. GBLC/G/821), Research Laboratories of the General Electric Company Limited, North Wembley, Middx. (M 45)

YOUNG Transformer SALES ENGINEERS required by important manufacturing company in London area. Degree or equivalent essential and previous transformer experience an advantage.—Applicants should give details of education, training, experience and salary expected to Box No. 1019, Electrical Times. (M 60)

**£50** a year TAX FREE is bounty paid to ELECTRONIC ARTIFICERS joining special section of the Supplementary Reserve. Men with City Guilds Final Certificate in Telecommunications and Radio and up-to-date experience in current electronic engineering practice will be needed to maintain electronic instruments controlling fire of anti-aircraft guns which protect vital centres of Great Britain should war break out. By joining the S.R. a man will not only be playing a vital part in the defence of this country but will also know his exact role in the event of war. Minimum rank Staff Sergeant. Minimum of 15 days training per year with Regular Army rates of pay in addition to bounty.—Further details from D.D.M.E., A.A. Command, "Glenthorn," Stanmore, Middlesex, or the War Office (A.G.10) Dept. E, London, S.W.1. (M 28)

## APPOINTMENTS FILLED

### UGANDA ELECTRICITY BOARD

THE Chairman of the Uganda Electricity Board wishes to thank all those who applied for the posts of ACCOUNTANCY ASSISTANTS in answer to the advertisement recently inserted in this paper. Over 100 applications were received and these are now being examined. Suitable candidates will shortly be invited to attend for an interview in London and they will be notified of the time and place by air mail letter from Uganda. (M 55)

## APPOINTMENTS WANTED

ELECTRICAL AND MECHANICAL ENGINEER with administrative experience; corporate member, I.E.E. Development, D.O., manufacture; rotary machinery, switchgear, gearing and electronics. Adaptable.—Box No. 9109, Electrical Times. (L 774)

ELECTRICAL ENGINEER, B.Sc., A.M.I.Mech.E., A.M.I.E.E., age 35, with experience of sales and service of motors and planning and installation of plant, seeks opening with good prospects.—Write, Box 167, Bennett Williams (Advertising) Ltd., 15a Westgate, Bradford. (L 644)

ELECTRICAL RESEARCH ENGINEER, 24, six years with well-known scientific instrument makers, requires position as technical representative London area. —Box No. 9071, Electrical Times. (L 663)

HONOURS graduate (27), PHYSICS AND ELECTRO-TECHNICS. Electrical engineering experience covers four years with Government Department and two years with leading concern. Position desired as Junior Sales Engineer with progressive organisation. Salary approx. £550.—Box No. 1017, Electrical Times. (M 58)

## WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed. Edgware 8631 (4 lines). —Service Electric Co., Ltd., Stanmore, Middx. (D 324)

ARMATURE SERVICE CO., LTD., Haddington Street, Hove (Tel.: 32996), electrical engineers and winding specialists. Distance no object. (F 739)

CASTINGS, Fisher Foundries, Ltd., Greet, Birmingham, have capacity for brass, gun metal and soft grey iron machine moulded repetition castings weighing 1-30 lb. Loose pattern work up to 3 cwt. Delivery by road to all parts. Tel.: B'ham. Victoria 0197. (L 318)

ELECTRICAL REWINDS AND REPAIRS. Switchgear and control gear rebuilt. Quick delivery.—Howard Motors (Nottingham) Ltd., Station Street, Nottingham. Tel. 40409. (L 672)

METALWORK. All types cabinets, chassis, racks, etc., to your own specifications.—Philpott's Metalworks Ltd., Chapman Street, Loughborough. (L 601)

## WANTED

A.C./D.C. MOTORS, STARTERS, complete change-over installation, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 5105. (A 20)

ELECTRICAL STEEL OFFCUTS required, minimum widths 3 in. by ·016 in. thick, any quantity up to 10 tons.—Write Box No. 9077, Electrical Times. (L 671)

ONE variable-speed commutator MOTOR, 36/74 h.p. 4:1 speed range.—Box No. 9079, Electrical Times. (L 699)

STEEL SHEETS, strip, bars, ALUMINIUM SHEETS and strip. Any quantity, immediate payment.—Grades Sheared Metal Co. Ltd., Green Lane, Hounslow, Middlesex. Telephone: Feltham 3274) (L 619)

WANTED, ROTARY CONVERTORS, any size.—Universal, 221 City Road, London E.C.1. (A 16)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper, Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Water-tube Boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath. (A 5)

WANTED, D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London N.1. (A 13)

1. 25/30 kVA also 15 kVA DIESEL ALTERNATOR, 400 V 3-phase 4-wire on baseplate, with accessories, also one single-phase 230 V a.c. 50 cy. generator, 50 amp., complete with Diesel power unit.—W. Hornsby Millom, Cumberland. (M 57)

## AGENCIES

MANUFACTURER of street lighting equipment and wide range of electric cooker accessories requires REPRESENTATIVES or AGENTS with first-class connections with British electricity authorities to cover the whole of England, Wales and Scotland.—Write, giving full particulars and area covered to Box No. 1021, Electrical Times. (M 63)

SCOTLAND. AGENCIES REQUIRED by firm of electrical distributors. Showroom in centre of Glasgow. Live sales organisation. Well established and holding agencies for first class heating appliances. Commission or buying basis.—Box No. 1011, Electrical Times. (M 37)

## FOR SALE

### CABLES & WIRE

AVAILABLE LONDON. Quantities of covered and bare Copper and Nichrome WIRE in gauges between 10 g and 50 g.—For full details apply: The Mulberry Company, 223 St. John Street, London E.C.1 (Phone: CLErkenwell 8356-7-8.) (L 794)

EARTH-CONTINUITY. Use the PORTAWAY EARTHING CONDUCTOR with the Fulgrip-Portaway bonding clamp for the most efficient earthing system. Send for new leaflet today: Porter Electrical Products Ltd., Bramhope, Leeds. Tel. 73428. (L 738)

REDUNDANT stock for disposal. 32/4/38 TINNED COPPER BRAIDING, below today's price.—Telephone WILlesden 3675. (M 42)

4 DRUMS 22 kV 0·13-core P.I.L.C.S.W.A. and served, each 166 yds., 1 drum, 15 ditto 100 yds.—Jobborn and Co., 38 St. Johns Road, Seven Kings, Essex. (M 61)

### DOMESTIC APPLIANCES

IMMERSION HEATERS, Grubb 4 kW. No purchase tax. All lengths, 16 in. to 36 in. Standard voltages. Provision for intermediate loadings. Fully guaranteed. Write for illustrated brochure, latest lists and trade terms to distributors.—John Owner and Co. Ltd., Springfield Road, Birmingham 13. Tel.: Spr. 2939. (C 392)

### ENGINEERING PLANT & MATERIALS

2 cwt 3 ft by 1 ft 6 in. by 0·025 in. EBONITE SHEETS, GRADE B. 15 cwt 3 ft by 1 ft 6 in. by 20 g EBONITE SHEETS, GRADE J. 2 tons 3 ft by 1 ft 6 in. by 0·437 in. EBONITE SHEETS, GRADE A. 15 cwts 4 ft 6 in. by 3 ft 6 in. by 0·437 in. SYNTHETIC RESIN PAPER BONDED BOARDS. 52 sheets 7 ft by 3 ft 6 in. by 1/8 in. BAKELITE PAPER BASE PLASTIC BOARD. 34 sheets 7 ft by 3 ft 6 in. by 1 in. BAKELITE PAPER BASE PLASTIC BOARD. 38 sheets 10 ft by 1 ft 3-ply WOOD BOARDS. 6 sheets 4 ft by 2 ft "WAYROCK" BOARDS. Also sheets in other sizes and thicknesses.—Full details of above on application to: The Mulberry Company, 223 St. John Street, London E.C.1 (Phone: CLErkenwell 8356-7-8). (L 795)

### GENERATING PLANT

ALTERNATING SET for sale. Motor driven, on base plate. Input 70 h.p., 1,500 r.p.m. d.c. Output 400 V, 1 phase, 50 c/s. Starter panel with shunt regulator and a.c. voltmeter.—F. J. Edwards, Ltd., 359 Euston Road, London, N.W. 1. Tel.: Euston 4681. (M 12)

GENERATORS. 600 kW shunt wound generator by G.E. of America. Protected type, separately excited, end-shield B.R bearings, 120/220 V, 1,205 amps., having special duty cycle for short duration, 3,000 amps at 180 V.

250 kW generator by Met-Vick, for 500/440 V d.c., 2 wire, 500 amps. Speed 375 r.p.m. Open type, compound wound.

200 kW generator by E.C.C., for 200 V d.c., speed 1,000 r.p.m. Open type, single pedestal bearing. Compound wound, fitted interpoles.

200 kW generator by Crompton, for 500/550 V d.c., speed 750 r.p.m. Open type, 6-pole compound interpoler wound. Single pedestal R.O.B.

200 kW generator by Mavour and Coulson, for 500 V d.c., 400 amps. Speed 380 r.p.m. Open type, 6-pole, compound interpoler wound. Single pedestal R.O.B.

165 kW generator by Mather and Platt, for 220 V d.c., speed 650 r.p.m. Open protected type, compound wound, two pedestal R.O.B.

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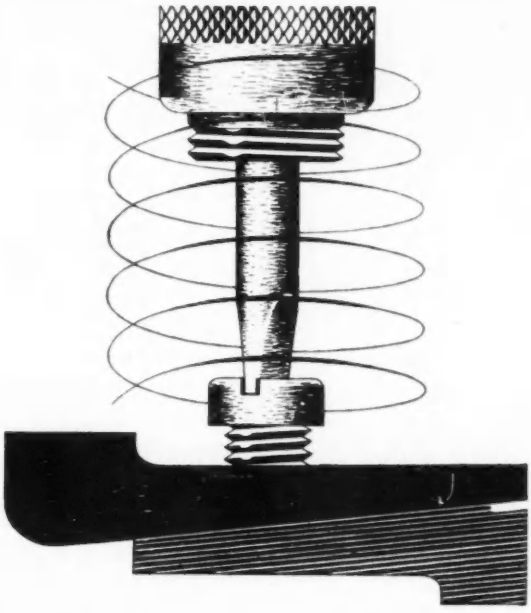

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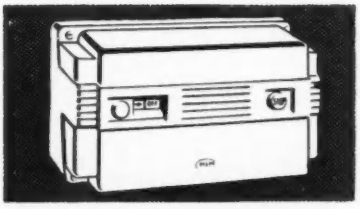

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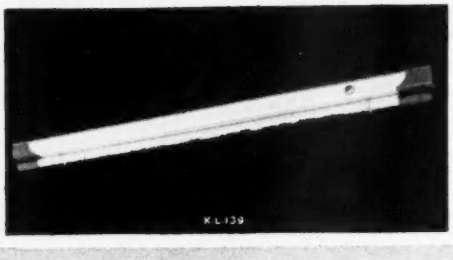


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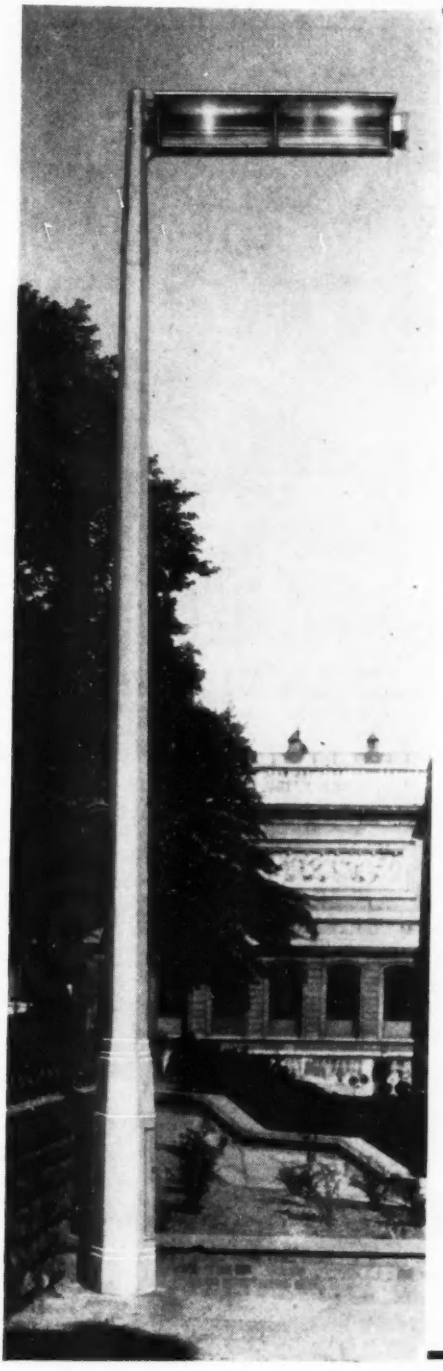

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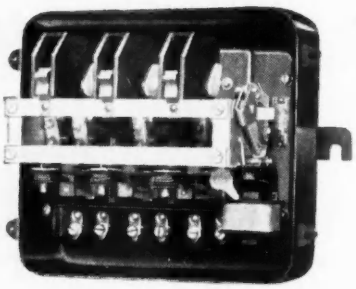

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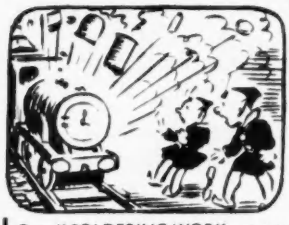

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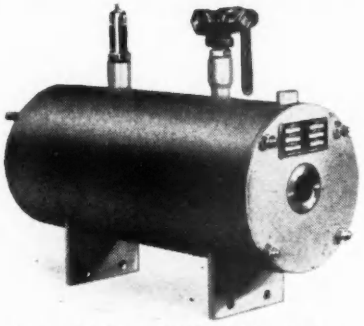

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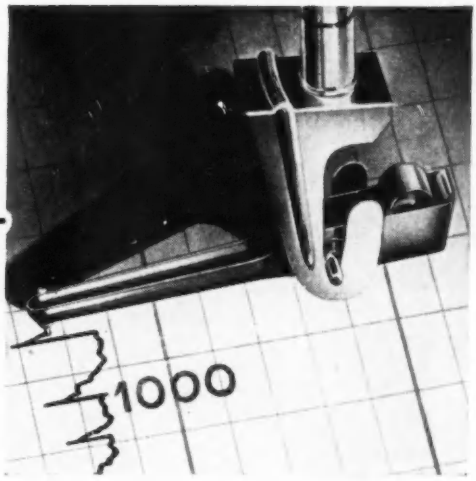


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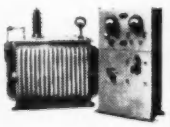

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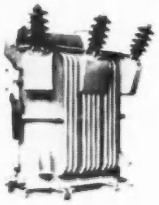

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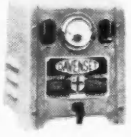


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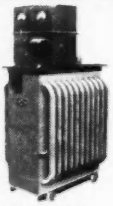

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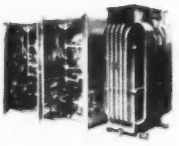

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For battery charging, cinema arc, and many d.c. industrial uses.

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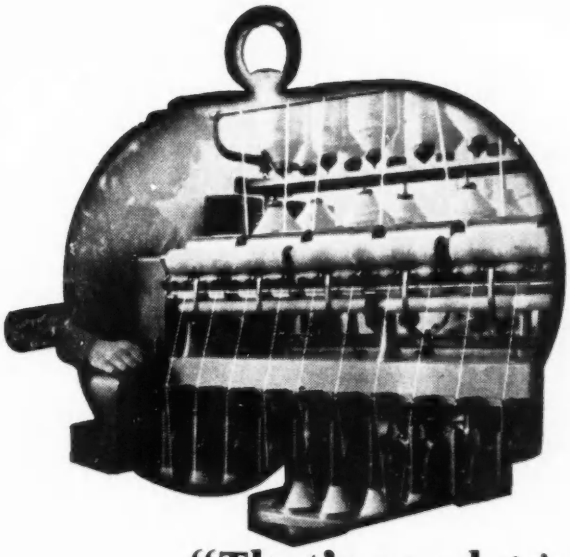

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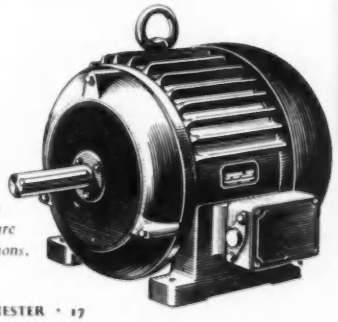

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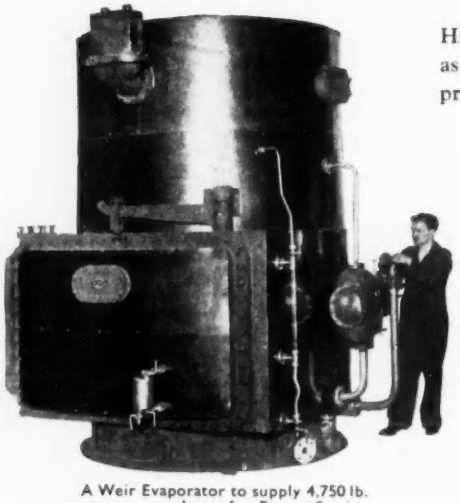
# WEIR EVAPORATORS



A Weir Evaporator to supply 4,750 lb. vapour per hour for Power Station

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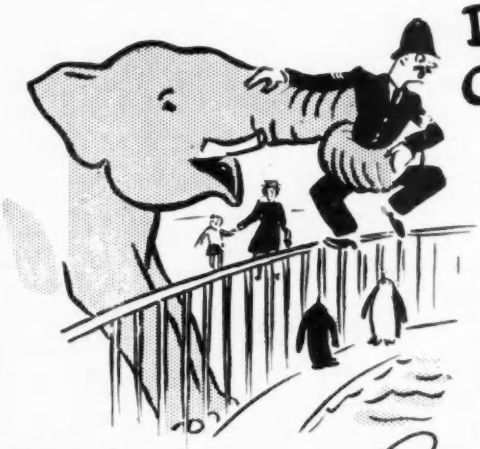

# DEPOSITION OF COPPER !

Hardly a definition which they would understand in the Plating Shop, but that's beside the point.

The point is that electrolytic plating equipment provides one of the very many applications for cables designed for more than usually arduous electrical and mechanical conditions; and it is in situations such as these that HACKBRIDGE cables prove their worth

**HACKBRIDGE** *Cable Company Limited*

In Association with BRYCE ELECTRIC CONSTRUCTION CO. LTD.

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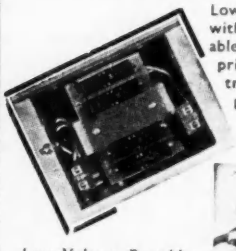
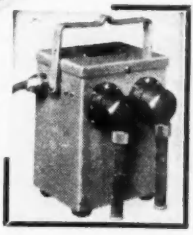
Branches at BIRMINGHAM, BRISTOL, CARDIFF MANCHESTER, NEWCASTLE, SHEFFIELD

## LOW VOLTAGE TRANSFORMERS



Low Voltage Lighting Unit with lid removed. Suitable for M/c tools, comprising double-wound transformer with fused primary and secondary D.P. on-off switch, housed in steel case.



Low Voltage Portable Transformer suitable for hand-lamps, portable m/c tools, etc. Fitted with Reyrolle plugs and sockets and carrying handle.

We specialise in the manufacture of LOW VOLTAGE TRANSFORMERS to customers' individual requirements. Single or three-phase from 50 V.A. to 25 k.V.A.

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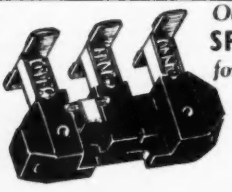

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**SWITCHGEAR SPECIALISTS**

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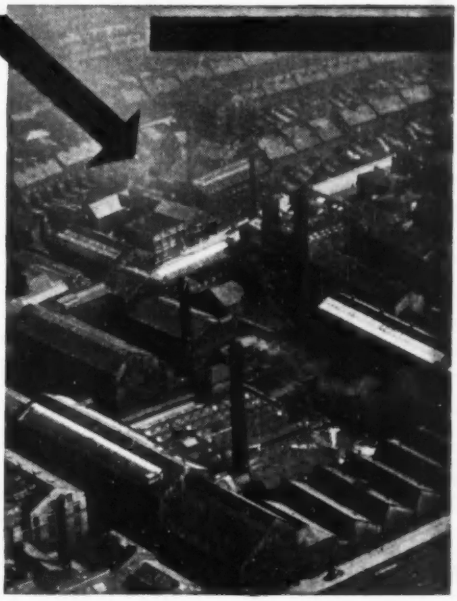

Muck and brass and lads and lasses and ee's and aye's and heights that wuther and Yorkshire pud and moors and mills and wool to clothe the back of Britain. Scratch a Yorkshireman and you find a weaver under the skin: a weaver who can make a loom dance, with the spindles jiggling and the yarn singing out into as fine a piece of worsted as ever went into the making of a suit. And behind the loom — electrical power. Power controlled to a nicety: a ceaseless, uncomplaining, seldom-failing servant putting more wool on your back and bringing more brass to the old country.

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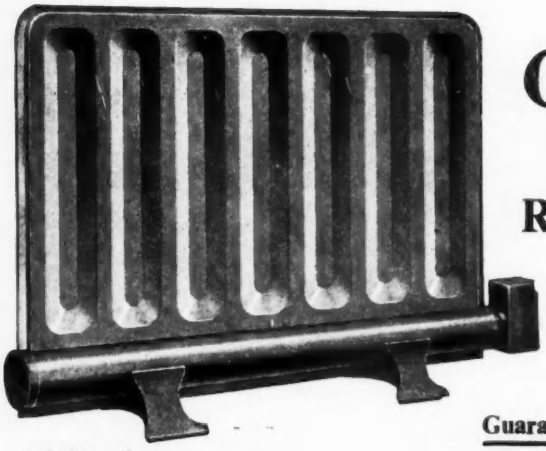

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## MAGNETIC DEVICES.
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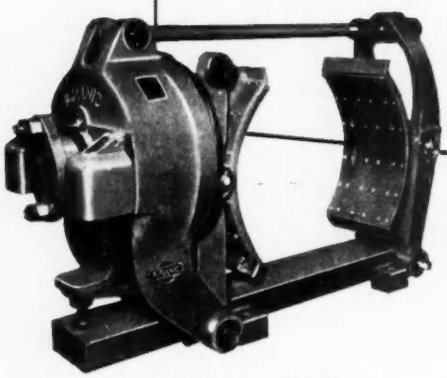

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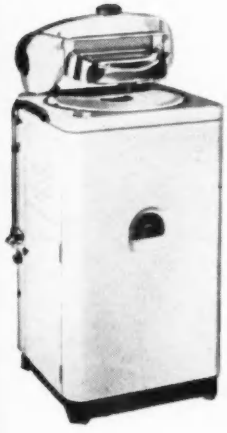
# CASTLE OF DREAMS

A Drawing Office isn't everybody's idea of a Castle of Dreams. Yet this fine Drawing Office in the Parnall factory at Yate is, in fact, a place where dreams come true. Here the needs and desires of housewives are translated on the drawing boards into those practical points of perfection which make the Parnall Washers and Cookers first favourites with most women.



The exceptionally handsome Parnall Electric Washer is the result of a careful survey of housewives' requirements. It handles a week's family laundry in one hour and among special features are the electric emptying pump, the very latest anti-corrosion treatment of metal parts and the storage recess for the Wringer.

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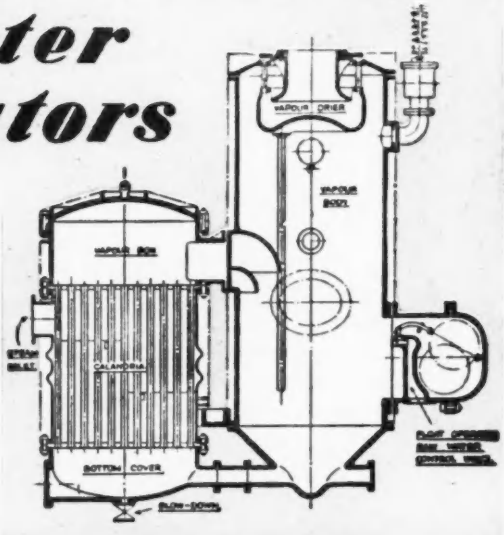
**Ample Surface—** Infrequent Cleaning

**Straight Tubes—** Easy Access

The drawing shows the sectional arrangement of a single effect Evaporator.

H104A

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